DOCUMENT RESUME

ED 113 544 CE 005 082

AUTHOR	Blair, Larry M.
TITLE	Mechanisms for Aiding Worker Adjustment to Technological Change: Volume 1: Conceptual Issues and Evidence.
INSTITUTION	Utah Univ., Salt Lake City. Human Resources Inst.
SPONS AGENCY	National Science Foundation, Washington, D.C. Office of National Research and Development Assessment.
PUB DATE	
NOTE	286p.; The bibliography for Part 2 is of marginal reproducibility; For abstracts of the literature reviewed and a subject index to the abstracts, see CE 005 083; For a commentary on implications, see CE 005 084
EDRS PRICE	MF-$0.76 HC-$14.59 Plus Postage
DESCRIPTORS	*Government Role; Policy; *Technological Advancement, *Manpower Utilization; *Vocational Adjustment; Work Attitudes; Private Agencies; *State of the Art Reviews

ABSTRACT

The report reviews current literature dealing with past/present/future mechanisms to assist workers' adjustment to technological change. A basic concern of the study is what level of government policy, if any, is needed in this area. Part 1 is a discussion of the conceptual impact of technological change on the labor market. The four chapters of Part 1 are directed to the effect of technological change on employment as related to production function, input prices, demand shifts, and skill sector requirements; worker adjustment to technological change through private/public adjustment mechanisms; other relationships between workers and technological change; and adjustment mechanisms and social well-being. Part 2, a review of current literature from 1965 through 1973, is anticipated to be representative of total work in the area. Chapter 1 of Part 2 summarizes findings on worker displacement, analyzes policy recommendations in the literature, and indicates needed research. Chapter 2 focuses on which types of workers are affected by technological change (skill, age, sex, ethnic groups, occupation, and industry). Chapter 3 reviews the private/public adjustment mechanisms and which workers benefit most and least from these adjustment mechanisms. An extensive bibliography accompanies Part 2. (EA)

MECHANISMS FOR AIDING WORKER ADJUSTMENT
TO TECHNOLOGICAL CHANGE
Vol. I Conceptual Issues and Evidence

ED 113-544

TECHNOLOGICAL IMPACT IN THE LABOR MARKET

CONCEPTUAL ISSUES

Volume I Part I
and
Part II

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Human Resources Institute
University of Utah

CE 005 082

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MECHANISMS FOR AIDING WORKER ADJUSTMENT TO TECHNOLOGICAL CHANGE

by

Larry M. Blair

VOLUME I

Conceptual Issues and Evidence

Final Report on

National Science Foundation Contract

# DA39438

This report was prepared under the auspices of a grant from the National Science Foundation, Office of National R&D Assessment. Opinions expressed are those of the author and do not necessarily represent the official position or policy of the National Science Foundation or of the University of Utah.

Human Resources Institute
University of Utah

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PREFACE

This report was compiled for the National R&D Assessment Program of the National Science Foundation to provide a basis for further research into the area of technological change and employment, and changes in worker well-being. The specific assignment dealt with the knowledge of the types of mechanisms which are available to workers to use in adjusting to technological change, what are the policy issues involved, and what are the areas where more research is needed. This is one of several related, often overlapping, projects funded by the R&D Assessment Program of the N.S.F. investigating the relationship between technological change and social well-being.

The deepest gratitude and thanks goes to project research associate, Mary Stevenson, without whose participation the project would never have reached a conclusion. Thanks goes also to my faculty associates for their advice and patience with my questions--Steve Seninger, Garth Mangum, Thayne Robson, and Chris King. The research assistants who, along with Mary Stevenson, reviewed the mass of existing literature in the field are Connie Johnsen, Margaret Redmon, Gail Shields, John Ammon, Robert Ellsworth, Scot Stradley, and Robert Murphy.

Appreciation is also strongly expressed for the work of Jane Bradley who edited the copy and to Linda Ewing and Mari Lou Wood who supervised the typing and reproducing of the report.

The many constructive remarks of Professors N. J. Simler, Robert Aronson, Fred Masserik, James Stern, and Jack Stieber plus those of Barbara Burns and Dr. Rolf Piekartz of the N.S.F., are incorporated into the final draft of the report. Responsibility for the final project, especially for all errors and omissions, rests with the author.

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INTRODUCTION

The purpose of this paper is to consider the current literature dealing with mechanisms which have been used, are used now or might be used to assist workers' adjustment to technological change which affects their employment and earnings. These mechanisms may range from simply letting the workers become unemployed and allowing the "market" to work as it may, to elaborate adjustment mechanisms set up by labor groups, management and/or governmental agencies.

A basic question of the study is what level of policy, if any, is needed in this area of economic activity. If the technological impact on workers is very slight, or if the private sector is handling workers' adjustment well, then no active government policy may be needed beyond aiding full employment growth. If the private sector appears to be able to handle the adjustment process adequately with the aid of better information, the government policy might consist simply of improving the flow of information. If problems do appear and persist as a result of technological change, then active government intervention may be called for in order to maintain workers' income-earning potentials and stability in the economy.

The study gives attention to which groups or types of workers are reported as affected by technological change; what mechanisms, if any, exist to aid the workers' adjustment; and which workers benefit most from these mechanisms. Recommendations for changes contained in the present "state of the arts" are outlined and criticized. The gaps in the knowledge are discussed, with attention given to priorities for future research that might close those gaps most essential for policy making.

The report is composed of two parts: Part I presents a discussion of the conceptual impact of technological change on the labor market. Knowledge of these conceptual relationships is essential in order to identify gaps in the existing knowledge and to establish effective policy. Part II contains the actual "state of the arts" study. It reviews the current literature, emphasizing the material published after 1965. (The National Commission on Technology, Automation, and Economic Progress, 1966, and other studies have covered the earlier literature quite extensively.) Part II concludes with recommendations for future research in the area.

An attempt has been made to review as much of the material relevant to this report as time and funds would permit. However, it was realized that many articles have been overlooked in the process because of time and funding constraints. The articles referred to are, hopefully representative of all the work that has been done in this area. An effort to cover material from all different areas and viewpoints was made in order to keep the report as unbiased as possible.

MECHANISMS FOR AIDING
WORKER ADJUSTMENT
TO TECHNOLOGICAL CHANGE

VOLUME I

CONCEPTUAL ISSUES AND EVIDENCE

VOLUME I

PART I

TECHNOLOGICAL IMPACT IN THE LABOR MARKET

CONCEPTUAL ISSUES

CHAPTER I

TECHNOLOGICAL CHANGE AND EMPLOYMENT

Technological Change and the Production Function with Constant Input Prices

Technological change can be classified as being neutral on the labor-capital ratio, labor saving (capital-using) or labor using (capital-saving) in its impact on the production function. Using a basic two factor production function, q=f(K,L), where q is output, K is the capital vector and L is the labor vector, a brief analysis of each type of technological impact will be developed. A detailed analysis of labor-capital substitution resulting from technological change is contained in the N.S.F., R&D Assessment Program study undertaken by New York University research team.*

Figures 1, 2 and 3 demonstrate each type of technological change on the production function. Three types of production functions are shown in each figure. A calculus type model with infinite divisibility of inputs is shown under (a) in each figure. A fixed coefficients of production model is shown under (b) with only one capital-labor ratio possible for

---

*Fritz Machlup and George Bitras, Effects of Innovation on Demand for and Earnings of Production Factors.

any given state of technology. A linear model with several process rays is shown under (c) which gives segmented straight line isoquants.* In addition, two different technologies are shown in each graph, T_1 and T_2, where T_2 is the newer technology that has been introduced to the production process.

Figure 1 shows technological change which has a neutral impact on the capital-labor ratio. This shifts the isoquants toward the origin in a parallel manner: i.e., on any ray from the origin, the ratio of marginal products remains constant with the technological change: e.g., $q=A_2K\ L$, where $A_1 < A_2$, thus $(mp_k/mp_l)= \frac{A_i\delta(K^{\alpha}L^{\beta})/\delta K}{A_i\delta(K^{\alpha}L^{\beta})/\delta L}$ = constant, for (K/L) = constant. In this case of neutral change, if the input prices stay constant then the total impact on labor is accounted for by the growth in technological efficiency for the given capital-labor ratio.

As shown in Figure 1, L_2L_l workers will become unemployed unless output increases enough to offset the efficiency improvement; i.e., unless there is a higher output under the new technology that would require at least L_l and K_l input usage; or unless some combination of adjustment mechanisms that increase employment by L_2L_l elsewhere in the economy are available to counter the employment impact.

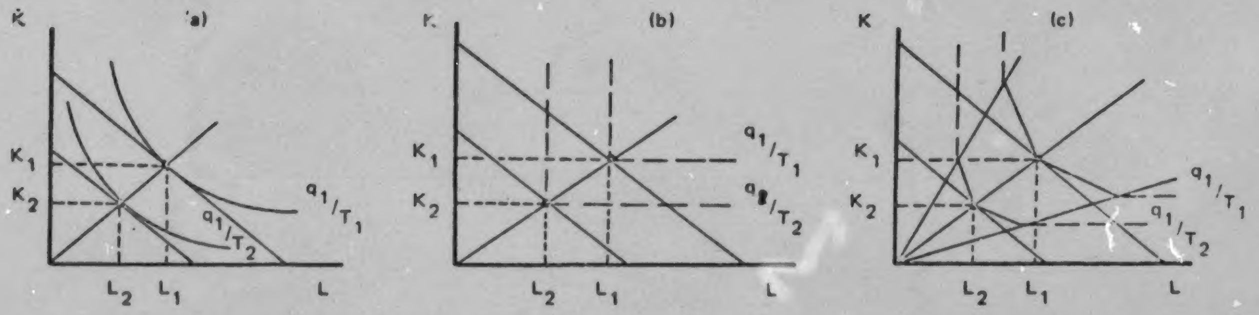
Part of the needed output stimulation should occur, even with constant consumer demand, becuase of increased productivity and lower cost

---

*An isoquant is a line showing equal output from various combinations of capital and labor when production is being carried out under the best possible technology that is currently available.

Figure 1

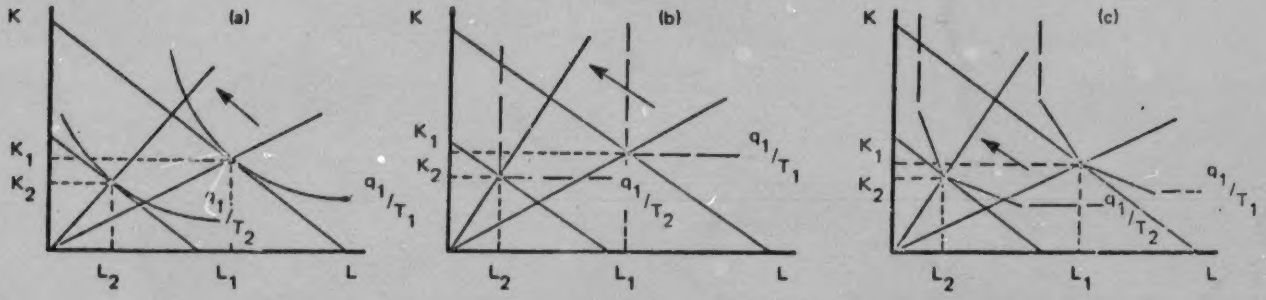
NEUTRAL LABOR-CAPITAL RATIO TECHNOLOGICAL CHANGE $K_1/L_1 = K_2/L_2$


K
(a)
K_1
K_2
q_1/T_1
q_1/T_2
L_2
L_1
L
K
(b)
K_1
K_2
q_1/T_1
q_1/T_2
L_2
L_1
L
K
(c)
K_1
K_2
q_1/T_1
q_1/T_2
L_2
L_1
L

ASSUMING constant input prices and $q = f(K_1 L)/T$

Figure 2

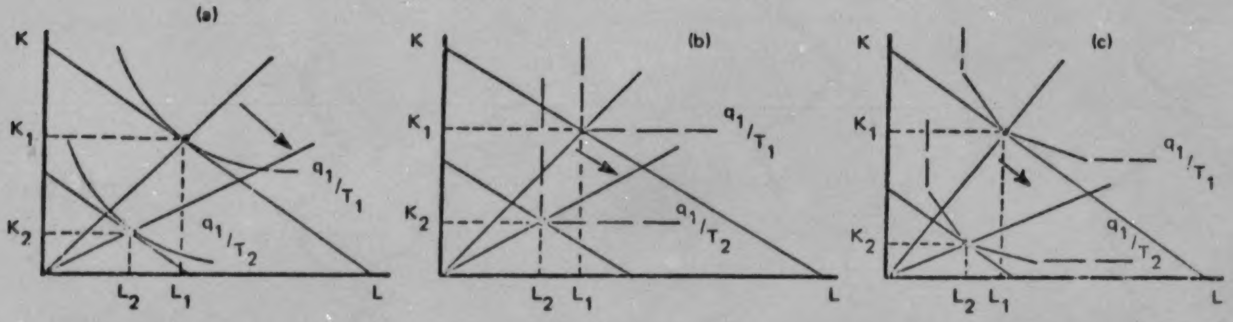
LABOR SAVING (CAPITAL USING) TECHNOLOGICAL CHANGE, $K_1/L_1 < K_2/L_2$


K
(a)
K_1
K_2
q_1/T_1
q_1/T_2
L_2
L_1
L
K
(b)
K_1
K_2
q_1/T_1
q_1/T_2
L_2
L_1
L
K
(c)
K_1
K_2
q_1/T_1
q_1/T_2
L_2
L_1
L

ASSUMING constant input prices and $q = f(K, L) / T$

Figure 3

LABOR USING (CAPITAL SAVING) TECHNOLOGICAL CHANGE, $K_1/L_1 > K_2/L_2$


(a)
K
K_1
K_2
q_1/T_1
q_1/T_2
L_2
L_1
L
K
(b)
K_1
K_2
q_1/T_1
q_1/T_2
L_2
L_1
L
K
(c)
K_1
K_2
q_1/T_1
q_1/T_2
L_2
L_1
L

ASSUMING constant input prices and $q = f(K,L)/T$

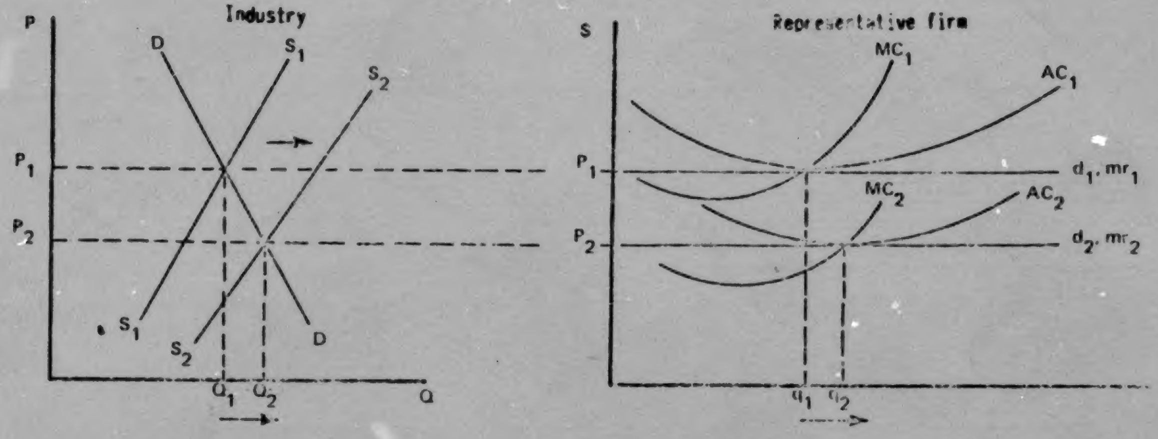
generated by the technological change. As firms react to the lower cost and adjust to the new profit maximizing output level, this should mean greater output and thus some increase in labor usage above the L_2 level. Figure 4 demonstrates this for a purely competitive industry, and Figure 5 for a firm in imperfect competition. It should be re-emphasized that, at present, the constant input price assumption is being used.

In Figures 4 and 5, the lower average cost, AC_2, was generated by the new technology, and this lower cost is shown as leading to a higher output at the profit maximizing point. This higher output would also result under average cost plus a constant percent markup pricing and under target return pricing. Thus, even with constant demand, part of the loss in employment, L_1L_2, (as shown in Figures 1, 2, and 3), may be offset by output increases brought about by lower cost, using the new technology. This increase in output and employment, due to supply side adjustment, should be allowed when discussing the amount of aggregate demand stimulation needed to maintain full employment.

Figure 2 shows capital using (labor saving) technological changes. This appears to be the type of change most often alluded to in discussions of automation and job loss since it "replaces men with machines." This occurs in the sense that the capital-to-labor ratio is increased for any given output level. The analysis in this case would be analogous to the earlier discussion of technological change which is neutral in its effects on the capital-labor ratio, except that now the impact on labor usage for

Figure 4

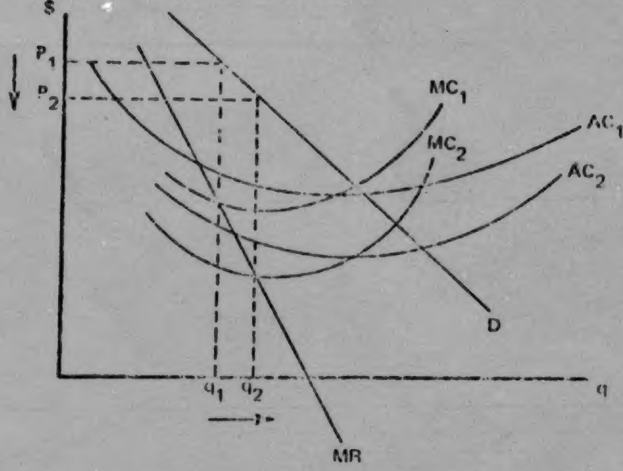
OUTPUT ADJUSTMENT AFTER TECHNOLOGICAL CHANGE IN PURE COMPETITION


Industry
P
D
S1
S2
P1
P2
S1
S2
D
Q1
Q2
Q
Representative firm
$
MC1
AC1
P1
d1, mr1
MC2
AC2
P2
d2, mr2
q1
q2

LONG run equilibrium positions shown

Figure 5

OUTPUT ADJUSTMENT AFTER TECHNOLOGICAL CHANGE IN IMPERFECT COMPETITION


$
P1
P2
MC1
MC2
AC1
AC2
D
q1
q2
q
MR

any given output level is greater, due to the labor saving aspect of the technological change. This means, of course, that to maintain employment greater output increases will have to be generated. This increase can come from the combined effects of increased demand and greater output due to supply adjustments brought on by lower cost, as discussed above, using Figures 4 and 5.

Figure 3 shows technological change which is labor using (capital saving). This is probably the least discussed of the three categories of technological change, at least in the popular literature, since it results in a decreasing capital to labor ratio and implies "man replacing machines", a process viewed as not very likely to occur. When it does occur, it means that for any given output level the effects of technological change are relatively greater on capital usage than on labor as compared to the neutral and labor saving cases. This type of change can still lead to less employment at any given output level, and therefore can create problems for workers, as shown in Figure 3; however, after output adjustments for cost reductions have been made, this labor-using type of change should require less demand growth (or perhaps none) to maintain employment levels.

These three types of fundamental shifts in the production relationship due to technological change and the resultant cost changes rising from the shift in the isoquants are the basic building blocks of knowledge for policy in the technological and labor areas. The following sections will explore aspects of these changes and their implications in much greater detail, as we focus specifically on our topic of current knowledge about actual adjustment mechanisms available for workers who are affected by technological change.

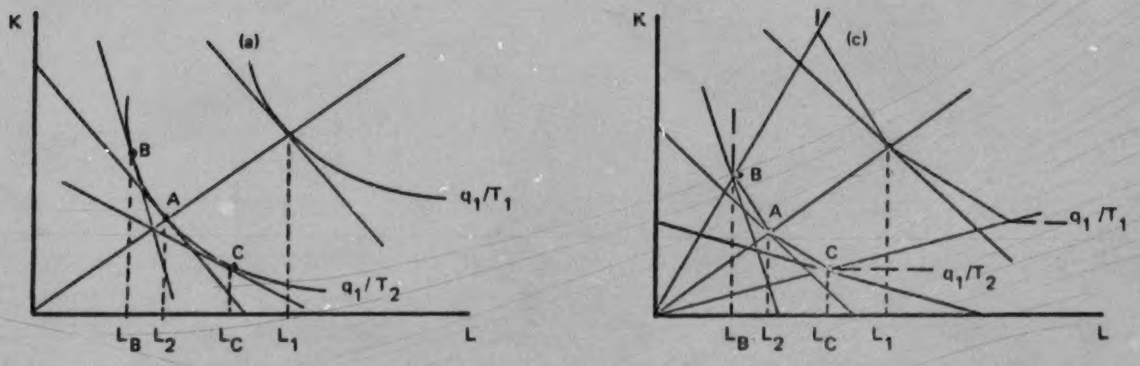
Technological Change Accompanied by a Change in Input Prices

In this section we will briefly look at the possible effects on labor usage of combined technological changes and a shift in the relative input prices brought on by the change. These price changes might result from one or more of the following: a new capital price as qualitatively new capital items are introduced; wage changes generated by a change in the labor skill mix required by the new technology; wage changes (or job requirement changes) resulting from unions' reactions to the technological change (or, expanding the model, from resultant changes in the input requirements and relative prices of any other input, e.g., energy and raw materials).

These input price shifts have two effects on labor usage. The first effect is shown in Figure 6, with the use of technological change that is neutral on its impact on the capital-labor ratio as shown in Figure 1. The analysis can easily be shifted to capital-using change, Figure 2, or to capital-saving change, Figure 3. This first effect is to increase or decrease the labor usage for a given output level, after adjusting the capital-labor ratio for the factor price changes. This is demonstrated in Figure 6 for the calculus type production model, 6 (a), and for the

Figure 6

TECHNOLOGICAL CHANGE ACCOMPANIED BY INPUT PRICE CHANGES USING NEUTRAL CAPITAL - LABOR IMPACT


K
(a)
B
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C
q_1/T_1
q_1/T_2
L_B
L_2
L_C
L_1
L
K
(c)
B
A
C
q_1/T_1
q_1/T_2
L_B
L_2
L_C
L_1
L

linear type model with alternative processes possible, 6 (c). The fixed coefficients-of-production model, as shown in Figures 1 (b), 2 (b), and 3 (b), is not affected since it offers only one capital-labor ratio to use.

The impact of a relative decrease in the price of capital is shown by a shift from A* to B, with the resultant greater employment decline from L_2 to L_b. The impact of a relative increase in the price of capital (labor becoming relatively cheaper) is shown by the movement from A to C which, at least, partially offsets the employment impact of the technological change by increases in labor from L_2 to L_c. It should be noted that in the case of the linear model, Figure 6 (c), a price change of significant proportions may be necessary to shift the optimal input combination off a given kink in the isoquant.

An often expressed fear is that not only do machines replace men because of purely technological improvements but also that the machines become relatively cheaper to use than men, and thus the employment problem is magnified, i.e., a L_2 to L_b type move. Clearly this must be a concern for policy makers, since cost changes may increase or decrease the employment impact of a change in technology. In anticipating the impact of cost changes, some very difficult estimates must be attempted. First, a cost of capital needs to be defined in a manner acceptable for production decisions; that is, in some sort of machine hour or other flow measure.

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*A is the input combination that would result if the input price ratio had remained constant.

Second, the reaction of unions and their resulting wage and fringe benefit* demands must be anticipated and some estimate of the actual wage cost settlement made. Third, even if no wage rate change per type of worker is anticipated, the actual wage cost of labor may vary due to the necessity of changing the skill matrix of employees to meet the requirements of the new technology.

The third factor mentioned above introduces another type of impact on workers that will be developed in a later section, but which deserves mention here; that is, as technology changes and relative input prices are altered, the mix of worker skills needed by the firm may vary. If this change in skills is significant then the old set of workers may not satisfy the new requirements. This would result in a large amount of labor turnover and the loss of jobs for some of the original workers. This skill-mix change and labor turnover could affect the firms cost function and output, and as a consequence, employment, by changing such costs as pension and retirement plans, training programs, severance pay, etc.

The second effect that a change in input costs may have on employment is shown by returning to Figures 4 and 5. This effect involves changes in the output level rather than simply changes in the capital-labor ratio for a given output level as discussed above. In order to calculate the additional employment impact in this case, an estimate of the change in the cost function needs to be made. If the average cost and marginal cost curves are lowered, as shown in Figures 4 and 5, then the profit maximizing firm or a firm using some sort of cost markup pricing would be expected to increase output from q_1 to a higher level and thus increased employment.

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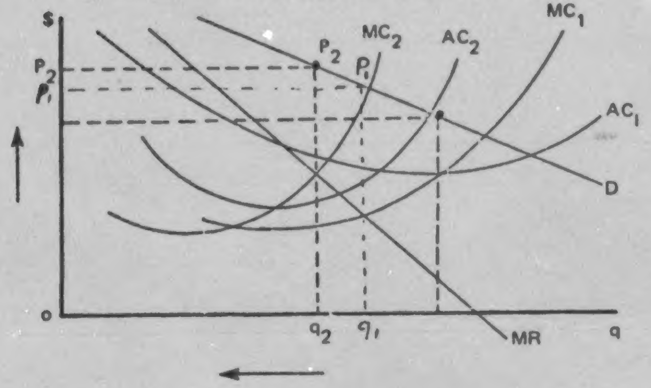
*The cost to the firm and to society of other types of adjustments due to union reactions will be discussed in later chapters.

It might be assumed that, in general, technological change would lower cost and promote higher output since this would follow profit maximization and market share maintenance concepts; however, it is possible that a new technology would cause a lower optimum output level if the same or even higher profit-sales ratios and profit-to-capital ratios were generated. An example of this is shown in Figure 7 for a profit maximizing firm. Here the average markup at q_2 under the second average cost curve is greater than the average markup for q_1 under the first cost curve. If the cost of capital involved in establishing cost AC_2 is significantly below that required for AC_1, then the rate of return on capital will also be greater and the firm will be induced to switch the technology in use and establish the plant with AC_2.

The second technology does substantially reduce the firm's flexibility in production, since it is much more expensive at higher output levels. In this case, additional output to meet expanding demand would have to come by setting up new plants not by expanding output within the original plant.

Figure 7
TECHNOLOGICALLY INDUCED COST SHIFT
RESULTING IN A LOWER OPTIMUM OUTPUT



Technological Change Accompanied by Demand Shifts

The act of changing the type of technology may, in itself, shift the demand curve (higher or lower) for the product, by changing buyer perceptions of the quality of the product.* This product variation may be "real" (i.e., measurable in some sense) or purely a perception on the part of the buyers. Thus the product variation may arise from actual changes in the physical makeup of the product (e.g., wallboard rather than plaster) or simply from consumers' belief that the new production process is better or worse than the old process. These perception effects could result from belief that the product is better due to automated quality control, or belief that the product has been cheapened by reducing the amount of skilled craftsmanship used in producing it.

If the effect is to reduce demand for the product at all price levels or to increase the demand at all price levels then, ceteris paribus, the output produced, and hence the level of employment would be decreased or increased, respectively. A shift in demand, however, need not be in the same direction at all price levels. Figure 8 demonstrates a case where demand has increased at lower price levels but decreased at higher price levels.

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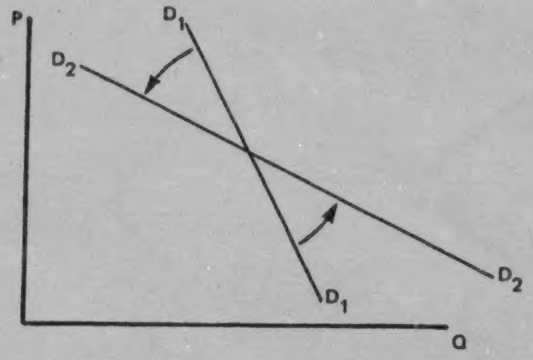
*This topic is explored in depth by two other N.S.F., R&D Assessment Program projects: (1) "Technological Change, Product Proliferation, and Consumer Decision Processes", Principal Investigator, Francisco M. Nicosia, University of California-Berkeley, School of Business Administration, and (2) "Diffusion of Product Innovations", Principal Investigator, Michael Gort, National Bureau of Economic Research.

Figure 8

DEMAND SHIFT BASED ON CHANGE CONSUMER PERCEPTIONS OF PRODUCT QUALITY DO TO TECHNOLOGY CHANGE IN PRODUCTION



One possible explanation for this reaction would be that at a low price the "new" product is purchased by a great number of lower income families because of a perceived greater durability and/or greater number of uses (i.e., more versatility and hence substitutability for a greater number of other goods). At the higher price levels however, the good is too high priced for most low income groups and is not purchased. Higher income groups may perceive the "change in the product" to be a lowering of its "quality" (perhaps because the product has less appeal as a status good, has less refined lines or is less delicate in its composition); thus, less is purchased by higher income groups at all price levels. At lower price levels, the increase in demand by lower income groups more than offsets the decrease in demand by higher income groups, to give a greater total demand than before the perceived product change (as shown in Figure 8). At higher price levels, however, lower income groups leave the market as is normal, and the reduced demand by higher income groups is great enough to cause the total demand to be even less. Obviously the impact on output and employment in the example shown in Figure 8 depends on the new price level that is established for the "qualitatively" new product. Cost considerations (as developed in the two preceding sections) would, of course, enter into the decision making for this new price.

In addition to changes in demand for the product whose production is directly affected, technological change can also affect the demand for other goods, substitutes and complements. As the price and quantity of a good sold change (1) due to its demand curve shifitng because of perceived quality change, or (2) due to cost changes brought on by technological change, the sales of other goods will vary and their prices will probably also change. These output and price changes may have feedback effects on the good whose sales and price were originally affected by technological change, and these interactions may also create further reactions in the economy as the need for a new general equilibrium is generated. Technological change in one industry can affect the output of other goods in the economy and hence affect employment in other industries, through the substitute and complementary goods relationships. Through feedback into the general equilibrium of the economy, the employment in the original industry may be affected further, as may employment in even seemingly unrelated industries.

Technological Change and the Labor Skill Vector Requirements

The first three sections have dealt mainly with the impact of technological change on the quantity of labor, (i.e., the number of employees used before and after the technological change). This section will deal with possible effects on the composition of the work force. Total employment may show little change; but as a result of the change in technologies, the skill-mix of the work force may change significantly. The skill-mix may also be affected by changes in the relative input prices resulting from the technological change as discussed in an earlier section. The skill-mix may be changed also as a result of bargaining agreements resulting from technological change which establish new job requirements and work rules. This last effect will be discussed in more detail in a later chapter.

A change in the skill-mix means, of course, a change in the occupational requirements; and this may result in a change in the personnel employed. This displacement of workers is a much discussed problem; for many people it appears to be the major problem encountered in periods of rapid technological change. If a change in skills occurs, it may mean a change in the relative use of different types of worker or the complete elimination of certain jobs.

Figure 9 demonstrates a shift in the skill-mix in use in favor of more skilled workers. Here labor is simply divided into two types--skilled S, and unskilled, U. The original skill-mix is shown by line M; but after the state of technology has been changed, the skill-mix is represented by line M_2. With M_2 the ratio of skilled to unskilled workers has increased; e.g., for S_1 the shift from A to B causes unskilled employment to decrease from U_1 to U_2. Thus, even if total employment in the industry stays constant (e.g., with a shift from A to C, where $U_1 + S_1 = U_3 + S_2$) some workers, (amount $U_1 - U_3$) may lose their employment because their particular jobs are eliminated.

Figure 9
SHIFT IN THE SKILL MIX

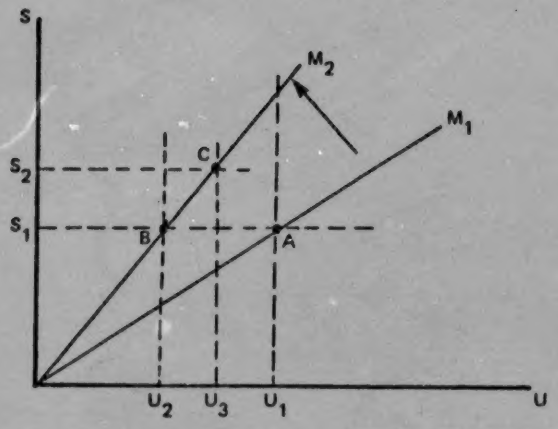

S
M$_2$
M$_1$
C
S$_2$
S$_1$
B
A
U$_2$
U$_3$
U$_1$
U

Figure 9 presents the view that automation or technological change causes a shift in the needed skill-mix to relatively higher requirements. The opposite, however, may occur. In the state of the arts section, some evidence and arguments stressing how technology lowers the average skill requirement, and, perhaps, eliminates the need for some high-skill trades will be presented. In Figure 9 this would represent a shift in the "M" line to the right of M_1. This reduction of skill requirements follows the concept of the assembly line, with workers each doing more and more "specialized" jobs until each worker does only one extremely simple job repeatedly over the working day.

If any policies are called for, these two opposite effects of technological change obviously call for vastly different ones. Much of current policy and policy proposals tend to view the effects of technological change as skill upgrading. Even if the opposite effect is occurring in only a few occupations or industries, these current policies will be of little value and may be the source of additional problems. Skill downgrading or upgrading may be related to technological change occurring in the form of more automated assembly lines (downgrading?) versus the development of automated factories (upgrading?).

CHAPTER 2

WORKER ADJUSTMENT TO TECHNOLOGICAL CHANGE

Displaced Workers: Reabsorption, Relocation, Retraining, Unemployment, and Labor Force Participation

The preceding chapter reviewed ways in which workers may become displaced because of lowered employment levels or because of shifts in skill requirements resulting from technological change. These displaced workers must either withdraw from the labor force, become unemployed, or move into another job, (e.g., undertake some form of labor mobility--industrial, occupational, and/or geographical). A more detailed analysis of labor mobility is presented in the report on "Manpower Forecasting and Technological Change" developed by Alan Fechter of the Urban Institute for the N.S.F., R & D Assessment Program, so only basic concepts will be presented here.

One basic mobility pattern that requires attention is that of intraplant and interplant job transfers with the same firm. Workers who solve their employment problems in this manner will not require any special policy considerations, unless the change involves a lowering of wages or other hardships which affects the worker's well-being. This transfer may be to a like job, or it may be to a job that is very similar and requires only a slight retraining for the worker. This retraining could be of an informal, on-the-job kind, or in formalized programs sponsored by the firm or union; in either case it is a private sector adjustment that may call for no public policy involvement. Finally, the worker could make a significant job change within the firm which requires considerable retraining, again with the training sponsored by the union or firm.

For those who become unemployed at one firm but regain employment, two basic reactions are possible. One, they found work in the same occupation, industry and region; or two, they stayed employed because of some type of labor mobility (i.e., employment in a new occupation, industry, and/or region). Again, no substantial public policy may be needed to aid in these situations. In cases where employment is maintained in the same firm or elsewhere an analysis of the socio-economic and demographic characteristics of those workers who are able to adjust as compared to those who are not may provide useful information. This analysis would have to include material on successful and unsuccessful job transfers, on the type of skill levels involved, on the type of industries involved (age, sex, ethnic group, marital status) and the geographic locations involved (region, urban, suburban, rural).

As mentioned above some or many of those who successfully change jobs are aided in this move by some sort of retraining process. Here the conceptual issues are (1) how many workers and which workers benefitted from company or union training and relocation programs, and what percent of the retraining was of an informal rather than a formal nature; and (2) how many workers and which workers benefitted from public-funded retraining or relocation programs. Both of these issues will be addressed in the state of the arts section of this report; however, the basic policy questions center on what programs are available and for whom, and how can the programs be improved, quantitatively and qualitatively.

The general state of the economy will obviously affect the ability of displaced workers to find re-employment. The ability of various subroups to find jobs at various stages of the business cycle has been researched to a considerable extent over the last ten to fifteen years.[1] These studies provide information that must be considered in analyzing the labor market reactions of workers displaced by technological change.

As indicated above, some of those who lose their jobs will simply withdraw from the labor force rather than become long-term unemployed. This represents a contraction of the labor supply, and it leads to underestimates of the number of people affected if only changes in the official unemployment rates are used to measure displacement. That is, the unemployment ratio = (number unemployed)/(number in the labor force).

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[1] See, for example, R. G. Lipsey, "Structural Unemployment Reconsidered," in A. M. Ross (ed.), Employment Policy and the Labor Market, Berkeley, Calif.: University of California Press, 1965, pp. 210-55. Herbert S. Parnes, "Labor Force Participation and Labor Mobility," A Review of Industrial Relations Research, Vol. 1, I.R.R.A., Madison, Wisc.; 1970, pp. 1-77; and L.E. Gallaway, Manpower Economics, Homewood, Illinois; Richard D. Irwin, Inc., 1971, Chapters 3,4,5,8-14.

To be counted as unemployed and as in the labor force the person must be actively seeking employment; thus those workers who drop out are not counted. This points out why examining changes in employment is usually more informative than examining changes in unemployment or unemployment rates.

Many of the displaced workers who drop out of the labor force are probably part of "the hidden unemployed" who would like to work and would reenter the labor force if they felt sufficient job opportunities were available.[2] The considerable amount of evidence developed in this area shows that the more marginal workers [teenagers, elderly, females (no head of family)], show considerably higher labor force participation rate elasticities with respect to job opportunities; thus job loss due to technological change would be expected to have a relatively greater impact on the labor force participation of these groups. This impact would be further strengthened by higher cyclical unemployment levels.

The concept of "hidden unemployment" is, however, a slippery one: If a person voluntarily withdraws from the labor force, it means the best wage offer available to him (possibly zero), is below his reservation wage. One way of interpreting the labor force behavior of so-called "marginal workers" is that on average, they have "better" nonmarket uses of time and thus have relatively higher reservation wages than other workers. If so, it is not clear that they should be singled out for any special policy consideration.*

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[2] See Seymour Goldstone and Dennis Schiffel, "Changes in Labor Force Participation, Employment and In-Migration in Sub-National Economies," Report for the Economic Development Administration, U.S. Dept. of Commerce, Contract N. 7-35384, Battelle Memorial Institute, Columbus Laboratories, Columbus, Ohio, 1971.

In addition to the possibility of creating hidden unemployment, technological change may create underemployment. The underemployed are persons who are displaced and can find only part-time employment, (though they might prefer full-time jobs) plus persons employed at jobs requiring much lower skill levels than they possess (e.g., engineers sacking groceries). Both of these represent loss of output to the total economy and probable loss of individual welfare due to lower income levels and/or lower job satisfaction.

Employment at a less than optimal skill level is more likely to occur in the event of technological change which lowers the average needed skill level. If this reduction is occurring generally throughout the economy, then it presents an extremely difficult problem; it means acceptance of the fact that there has occurred excess investment in human capital development for which costs there exists no means of recovery. Even if this underutilization of skills is only temporary, it has longer run implications when skills are dulled by non-use and/or new techniques are not learned.

As indicated at the first of this section there are many studies stressing this displaced worker problem as the main problem created by technological change rather than stressing the problem of generally higher unemployment. This was the argument expressed by the deficient-aggregate demand proponents in the early 1960's and endorsed by "The Report of the National Commission on Technology, Automation, and Economic Progress."[3] The early manpower programs were advocated on this basis, and the original Manpower Development and Training Act was designed to retrain family heads who had become unemployed as a result of technological change or as a result of shifts in the structure of demand for goods and services.

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*The author wishes to thank Prof. N.J. Simler for pointing out this argument.

The actual impact that manpower programs have had in aiding the adjustment of technologically displaced workers is covered in this study in the state of the arts material; however, the growth in the teenage and female proportions in the labor force over the last decade deserve special mention here, since these are considered, on average more marginal, lower-skilled workers and (or more likely to be confined to low-skill jobs), thus more susceptible to displacement by automation. This assumes automation hits low skill jobs harder: an assumption not accepted by all researchers in this field. Table 1 shows the growth in the labor force of these two groups. The displacement problems that technological change creates for these workers and for older workers and ethnic minorities needs special attention; they suffer in general, higher unemployment rates and greater adjustment problems.

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[3] National Commission on Technology, Automation and Economic Progress, Technology and the American Economy, Vol. I, Washington, D.C.: U.S. Government Printing Office, 1966.

Table 1

LABOR FORCE PARTICIPATION 1960-1970

	1970		1960	
	Total Number	Percent of Total	Total Number	Percent of Total
Total Population	82,897,433	100	69,877,476	100
Females	30,820,770	37	22,409,756	32
Teenagers (14-19)	7,050,314	9	4,970,045	7

Source: U.S. Census of Population, 1970, Washington, D.C.: U.S. Government Printing Office.

Other Private Adjustment Mechanisms

In addition to in-firm transfer, labor mobility and public and private retraining programs as mentioned above, a variety of other adjustment mechanisms appear, at least conceptually, to be feasible methods by which to aid workers displaced by technological change. In the private sector these can be broken down into the broad categories of job protection, work sharing, income securities, re-remployment aids and bargaining procedures.

1. Job Protection

Seniority systems and attrition schemes appear to be one way of reducing the displacement of older workers. Because older workers have greater problems finding new employment and have fewer years to recover the costs of geographical moves and/or retraining, it may be appropriate to attempt to make these workers more secure in their employment. The seniority system is of maximum benefit to the older worker when it extends over all plants owned by the firm. Systems which include only workers within a single section of the plant or across the single plant do not aid the older worker if the section or plant is eliminated by technological change.

Attrition schemes let the reduction in employment levels occur through normal retirements, job quits and transfers rather than through layoffs. Attrition obviously protects jobs for all workers, not only older workers, and reduces the older-younger worker fractions that might occur under seniority systems where older workers can transfer in and "bump" younger workers. Also, under attrition schemes, if demand for the output grows and thus the derived demand for workers increases, the firm has a trained work force present. Workers do not have to switch employers and occupations, thereby losing skill experience and seniority rights and incurring job turnover problems.

Also of aid in maintaining the employment of younger workers are early retirement programs whereby senior workers are induced (bribed) to withdraw from the work force at an earlier than usual age or after employment of some specified number of years in the industry. These retirement programs can be payments for non-participation in the industry or for complete cessation of labor force participation. Early retirement programs would have to make non-work attractive in order to be effective, unless a mandatory retirement age or maximum years of employment were established. To be attractive, the early retirement program would have to maintain income at a satisfactory level, insure no great loss in Social Security benefits and provide adequate health insurance coverage that is often lost at retirement at an age too young for Medicare coverage.

One practice to protect jobs that has been attempted and discussed since at least the beginning of the factory and implementation of machines is the use of job requirements or work rules, or "featherbedding and work slowdown" as it is referred to by opponents. Here the practice involved either an informal work slowdown or the establishment of formal job requirements detailing the actual duties of each particular job and the number of employees necessary to engage in any particular work activity. If technological change threatens jobs, then these practices help maintain jobs. This type of job protection has received a great deal of attention and has been attacked as inhibiting technological change, productivity improvements and cost reduction. In this view "featherbedding" is particularly harmful to the long run growth and welfare of the economy. Workers and union spokesmen counter that the individual's welfare is of first priority, and loss of a job can be disastrous to the individual and his family. Other jobs are not readily available (the classical full-employment model is unacceptable), and job change is expensive. Furthermore, many job rules are defended as being necessary in order to insure the worker's health and safely and to keep the job from becoming dehumanized due to excess demands on the worker.

The opposites of the rigid work requirements systems are the various job flexibility concepts. Here the workers or their union spokesmen allow the firms more flexibility in job assignments and worker tasks in the expectation that this flexibility will produce cost reductions, resulting in greater output and helping to maintain employment. Job flexibility can also be introduced by the company; that is, the new work tasks created by the technological change can be broken up into more elementary functions which will allow the use of lower-skill workers. This helps maintain employment for the low-skilled and may save the firm money by reducing the need for high-skilled, high paid workers and by reducing possible labor problems and work stoppages.

One of the obstacles to union endorsement of job flexibility and job transfers is the workers' fear of sizeable cuts in their paygrades as their job assignments vary. One way to minimize this is to establish a maximum on the number of paygrades a person may be lowered when he is transferred or when his job duties are redesigned.

Management may also aid in protecting jobs by their choice of the type of innovation (i.e. technology) to implement or by their timing of the introduction of the new technology. Union-management cooperative actions may affect this choice of type and timing of the innovation, as may the threat of union resistance to any change that greatly affects employment.

This choice of type of innovation may affect the labor-skill mix required and thus affect the employment of various groups. Also the choice of type of innovation may affect the new optimum output level for the plant (see analysis used in Figures 4, 5, & 6) which affects total employment If innovative changes in production are timed so as to coincide with economic growth periods, then the employment impact will be greatly reduced; and any workers displaced in the change will have a greater chance of finding re-employment.

The state of the arts section will discuss the impact of union resistance to technological change; but obviously, management must anticipate these reactions and calculate the extra cost involved. If the technological change will still give a reasonable rate of return after adding in the cost of this potential labor unrest, then management should proceed with it. If the potential labor unrest makes the expected rate of return on the investment too great, then management would be expected to give up the venture and either to switch the type of technological change to one more acceptable to labor or to keep the old process. If this is viewed as damaging to economic growth and society, some form of public involvement may be called into action.

Two union actions by workers appear as likely methods of aiding in the preservation of their jobs. First, in firms where workers are organized in several separate unions (along a craft, department or plant basis), the creation of a single union (e.g., a multicraft union), may aid in retaining jobs. This movement makes the workers potentially stronger, since they present one united front to management; also, it means that the firm cannot get around any one separate union by simply eliminating that total craft, department, or plant. This latter approach of choosing a type of technological change which eliminates all workers in a union is, conceptually at least, a method by which management may overcome union problems connected with technological change. The multicraft union makes this much more difficult, if not impossible. The multicraft union allows for a wider seniority base and more possibilities for job transfer and intrafirm relocations (as discussed earlier).

The second union movement to be discussed is the growth of white collar and professional unions. Part of the growth may have resulted from the impact of automation which has eliminated jobs or drastically altered the work activities and satisfaction of white collar workers. If technological change instills a growing fear among white collar workers of being phased out, unionization may appear attractive as a method of preserving jobs. Technological change may create white collar alienation and lower white collar workers' feelings of being "company men", thus making unionization more attractive.

Many of the discussions concerning job protection implicitly or explicitly touch on the concept of workers' property rights to their jobs; that is, the relation between the employer and employee may be viewed as something beyond a simple payment for labor services rendered and paid for as needed by the employer. The view has and is being expressed that the worker has a right to his job. In our society where distribution is based on income and most income is received by providing labor services, it is essential to the worker's welfare and his family's welfare that his stream of wage or salary income not be cut off. Implicit or explicit in this is the belief that the economic system does not offer full employment opportunities to all, or at least not at the same skill and earnings level.

While technological change may benefit management, capitalists and society as a whole through greater productivity, the individual worker who becomes displaced and suffers a loss of earning has few or no alternatives available to him to maintain his well-being. This is clearly not a Pareto optimal solution for society. If society has no policy to maintain the worker's well-being when he is threatened by technological change, the concept of a worker's having a property right to his job may be advocated. The relationship between employer and employee then becomes a social contract, giving the worker a source of income and a guarantee of a continuous income stream during his working life. The implications of this concept on economic growth and social well-being will be discussed further in the last chapter of Part I of the report.

2. Work Sharing

One method of easing the employment impact of technological change is to share the remaining work load by reducing the hours worked by each employee. Historically the increase in worker productivity has been used jointly to increase workers' earning and to reduce the number of hours worked. This type of adjustment is still being advocated by many unions and other researchers and writers in the field. It has been used in many instances over the last few decades as a method of combatting layoffs and unemployment in several unions and industries. The thorny issue is whether or not the reduction in hours worked is to be accompanied by offsetting wage increases to maintain old earnings levels.

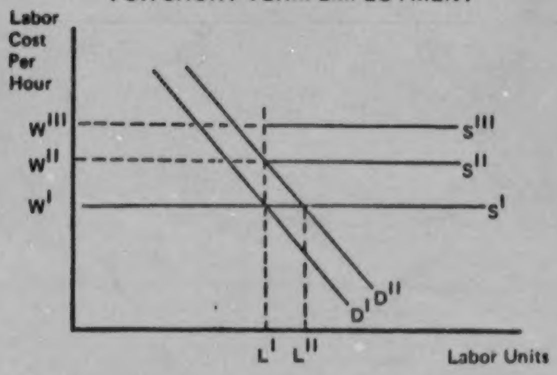
The average weekly hours of work has dropped little since 1929 (when it was approximately 40 hours per week); however, the reduction in actual hours worked over the year has continued through the introduction of more holidays and longer vaction periods. This approach is also advocated as a method of easing any worker displacement generated by technological change. The state of the arts section will discuss some recent uses of this technique. Because holidays and vacation time are normally paid time, it means the worker does not suffer any cutback in his earnings while he does increase his leisure time. This approach would seem to be a most favorable one as far as labor is concerned.

Three other methods of sharing the work are attrition policies, early retirement, (both discussed above), and reduction of overtime. Attrition and early retirement both affect the continued employment of those already at work in a firm or plant. Reduction of overtime may also aid in continuing the employment of those already at work by spreading the work to more people. Employees who are displaced from one department may find work in another department which had been using considerable man-hours of overtime, but which with the reduction or elimination of overtime, now needs more employees.

The reduction of overtime on an industry, occupation, or national basis may, in addition create more jobs in total, thus aiding aggregate employment. (Potentially, early retirement on a large enough basis could do the same thing). The total amount of employment generated would depend on (1) management's expectations regarding how long the extra work will last and (2) the cost of hiring and training the additional workers versus the costs of delaying production, distribution, sales and/or servicing the the firm. That is, if management is to hire additional personnel to meet output and sales requirements rather than to use existing employees on an overtime basis, the extra cost involved must not exceed the expected gains in revenue.

Figure 10 may be used to demonstrate part of the process involved in the additional hiring decision. Initially the demand for labor is at D', as based on the expected demand for the final product. This gives employment of L' for the going wage rate of W'. W' is the hourly wage cost when, the worker is assumed to stay on with the firm over the long run. Demand for labor then increases to D" because of an increase in the demand for the final good or service. The question is how long will demand D" hold up. If it is expected to be a long run phenomenon

Figure 10
LABOR COSTS OF ADDITIONAL HIRINGS
FOR SHORT TERM EMPLOYMENT


Labor Cost Per Hour
W'''
W''
W'
S'''
S''
S'
D'
D''
L'
L''
Labor Units

then the old hourly wage cost, W', may be used in hiring additional workers and employment L" will occur. If, however, the higher demand, D", is expected to last for only a short period the cost of hiring additional workers goes up, since the firm has less time in which to recover training and hiring cost and they must pay for any change in their unemployment fund tax brought on by fluctuations in their employment levels. If the increased demand is expected to be extremely short in duration, then wage cost W" may be the appropriate level which raises the supply of labor to S" to the firm; this results in no increase in employment. If any employment increase is to occur, then the increase in demand must be viewed as occurring for a long enough time period to reduce the wage cost to below the W" level (i.e., lowers the supply of labor below S").

After this decision has been reached and extra employment is viewed as feasible, then the gains from this approach versus the gains from just letting extra demand queue up and filling it as slack production time becomes available and must be considered. Only if producing the additional output now is found to be the optimal approach will additional workers be hired. It can be seen, then, that the reduction of overtime by itself is no guarantee of increased employment opportunities.

3. Income Securities

When it becomes obvious that fewer workers are to be employed by the firm, the workers and their union representatives next fall-back position is likely to be some sort of sharing of the increased profits through a supplemental unemployment benefits arrangement (S.U.B.), a guaranteed annual wage (G.A.W.), or through a profit-sharing arrangement.* The guaranteed annual wage might be thought of as a job protection scheme; however, the employee is paid the wage whether he works or not.

The G.A.W. or S.U.B. payments are usually established for workers who have been with the firm a minimum number of years and who meet other eligibility requirements. The S.U.B. payments are paid for a given number of weeks of unemployment, while the G.A.W. may be paid over a considerable number of years or even until normal retirement. Both measures are attempts to ease the worker's shifts to unemployment and allow him adequate time to find another acceptable job or to be recalled by the original firm. As discussed at length earlier, these measures are based upon the assumption that the individual worker should not suffer because of a technological change from which the firm and society-at-large benefit. If the worker is to be a risk-taker, then he is entitled to part of the profits as a reward for this.

Profit sharing is, of course, most beneficial to those workers who remain employed with the firm. It is often implemented in connection with union acceptance of greater managerial flexibility in setting work standards and job tasks, and in introducing technological improvements. For those workers who become unemployed during the process, the share or profit rights they have earned up to that time are viewed as an additional source of income, if needed, during their period of unemployment and adjustment. Thus profit-sharing may be used as a supplemental unemployment benefit, but at the discretion of each individual worker.

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*Plus the possibility of early retirement programs as discussed earlier.

Kelso and Hetter[4] have developed an interesting theory related to the profit-sharing concept. Under their system everyone--workers and non-workers-- would become stockowners in corporations. The initial step would be to make all workers stockowners in their own firms. The ownership process would be facilitated by a system of loans which would be paid off through the stock earnings. Other measures, such as elimination of the corporate income tax, are involved as well. Kelso and Hetter believed their system would promote production, demand, productivity improvements and employment and that it would eventually eliminate poverty. Everyone would be an owner of capital; and this "universal capitalism" would turn the work ethic into a broader "production ethic" which would benefit all of society, collectively and individually,

Early retirement plans have been discussed earlier as a means to improve employment opportunities for younger workers. A discussion now of the income security features contained in early retirement plans. When older workers are threatened with job displacement they face a difficult task in finding re-employment; and they may expect gains from retraining or relocation to be quite low. Older workers have fewer years left to recover the cost of human investment; and relocation may be, psychologically and emotionally, a very painful experience. For these reasons the possibility of early retirement with a guaranteed income may be an attractive alternative. The attractiveness of early retirement is enhanced if other fringe benefits are maintained. These include the availability of medical insurance until Medicare eligibility is reached, and the continuation of payments into the Social Security system until age sixty-five, so that no loss in Social Security benefits occurs.

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[4] Louis O. Kelso and Patricia Hetter, Two-Factor Theory: The Economics of Reality, Vintage Books, New York, 1967

One of the problems encountered by older workers when they contemplate a job change is the loss of pension rights they have accumulated in their present position. This would appear to be a restricting factor in the labor mobility of older workers and a factor which would lead older workers to attempt to maintain their jobs through restrictive work rules, wider seniority units, attrition plans, etc. To overcome this obstacle to labor mobility various methods of vesting the pension rights of workers have been advocated.

Severance pay plans have been established in various fields as a method of maintaining workers' income after they have been laid off. Unemployment compensation (for those eligible) does not maintain earnings at the workers' old income levels; therefore, those promoting severance pay systems argue that the extra funds allow the worker the time and money needed to seek re-employment in a job requiring similar skills with wages in line with his past earnings. It gives the worker a means of paying for geographical relocation or perhaps for retraining, if this is necessary or desired. Also, a sizable severance pay may be used as a method of compensating workers displaced by technological change in return for worker acceptance of change.

4. Output, Prices, and "Protected" Jobs

The last three sections have introduced various "adjustment mechanisms" which involve agreements between employers and employees which go beyond the wage rate. These various proposals involved some sort of employment guarantee such as the guaranteed annual wage, restrictive work rules, attrition plans, etc. One obvious question is the impact these plans have on resource allocation, prices, output and, ultimately, on employment. Norman J. Simler[5] has explored the impact of two types of work rules (or "featherbedding" as view by some.) Professor Simler's arguments are summarized and commented on below.

The first type of situation explored is that in which a minimum number of employees are required to be carried by the firm. This would be the case in the guaranteed annual wage systems or under the attrition formulas. Figure 11 shows the production functions under these conditions. Assume L_M is the minimum amount of labor required under the labor-

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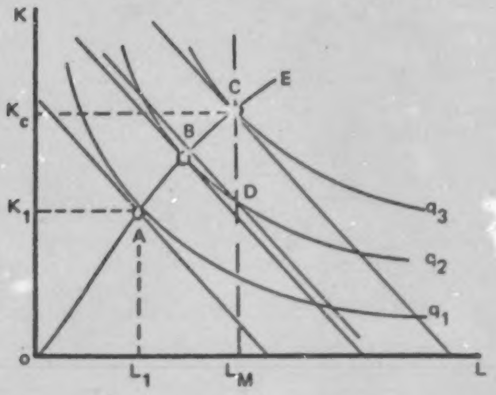
[5] Norman J. Simler, "The Economics of Featherbedding," in Featherbedding and Technological Change, ed. by Paul A. Weinstein, Boston, Mass.: D. C. Heath and Co., 1965, pp. 55-65.

Figure 11

MINIMUM REQUIRED EMPLOYMENT AND THE PRODUCTION FUNCTIONS.


K
K_c
K_1
O
L_1
L_M
L
A
B
C
D
E
q_1
q_2
q_3

management agreement or contract and the isoquants show the efficient labor-capital combinations for various output levels under a new technology. With this new technology and the present labor and capital prices, the cost-minimizing methods of producing any given output are shown by the expansion path $\overline{OABCE}$; but with the minimum labor requirement, the actual expansion path becomes $\overline{L_MDCE}$. Thus, for any output below q_3 the optimal capital-labor combination is not being used and the total cost of producing any output levels below q_3 is higher, (e.g., Pt. D versus Pt. B for q_2.)

Figure 12 presents the effects of this labor requirement on the cost curves for a monopolist; Figure 13 presents the effects for the purely competitive industry. Because of the non-cost minimizing capital labor ratio below the q_3 output level, the total cost of production will be higher in this range, and so the average cost will be higher, (AC" >AC' below q_3 output in Figures 12 and 13). A key factor, however, is the shift in the marginal cost curve. Since L_M amount of labor is required, labor cost up to that level is a fixed cost and imposes zero marginal cost from an output of zero up to q_3; so changes in capital usage (and in other non-labor inputs in general) are the sources of marginal costs below output q_3. These other inputs would be used in lower amounts with the fixed labor than without it; thus the capital to labor ratio is less than along the optimal expansion path. It can be assumed therefore, that the marginal product of capital is greater when expanding along the $\overline{L_MDC}$ path rather than along the $\overline{OABC}$ path; thus the marginal cost is less. MC" is less than MC', as shown in

Figures 12 and 13, where MC" represents the marginal cost associated with expansion path $\overline{L_M DC}$.*

At the firm level the reduction in marginal cost means that the output level and the employment are both increased for profit maximizing firms if the optimum output is below q_3, (i.e., within the area where the minimum labor requirement is binding). This increase in employment at the firm level occurs both in monopoly (see Figure 12) and in pure competition (see Figure 13).

At the industry level, however, quite different results occur. In monopoly the firm is the industry; thus the effect of a guaranteed annual wage or attrition could be an increase in output, a reduction in price to consumers and an increase in employment. (However, if the monopolist was using average-cost pricing techniques it probably would result in less output, higher prices and less employment.) In pure competition the increase in average cost must be passed on to the consumer in the form of a higher price; thus with a static demand this higher price (P" P' in Figure 13) results in less quantity sold in the industry. This means that employment in the total industry must be reduced by firms going out of business. As would be expected, in pure competition a minimum labor requirement creates less efficient production methods which lead to higher consumer prices, lower output and less employment at the industry level.

The second type of work restriction considered by Professor Simler is one in which the capital-labor ratio is fixed at a maximum. This would correspond to the case of strict, inflexible job requirements being

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*Let $q = f(K, L)$, thus with the fixed labor requirement $q = f(K, L_M)$. $C' = P_K K + P_L L$ and $C'' = P_K K + P_L L_M = P_K K + \alpha$ where C" represents the cost for outputs and L_M is a binding constraint. Thus, $MC' = \delta C'/\delta q = P_K(\delta K/\delta q) + P_L(\delta L/\delta q)$ while $MC'' = \delta C''/\delta q \mid L_M = P_K(\delta K/\delta q \mid L_M) + 0$ and $MP_K = \delta q/\delta K \mid_{L_M} > \delta q/\delta K$ for $L_M > L$ when L is variable, thus $MC' = \delta C'/\delta q > \delta C''/\delta q = MC''$ for $L_M > L$ under C'.

Figure 12
MONOPOLY – COST CURVES, OUTPUT, AND PRICE UNDER A MINIMUM LABOR USE REQUIREMENT

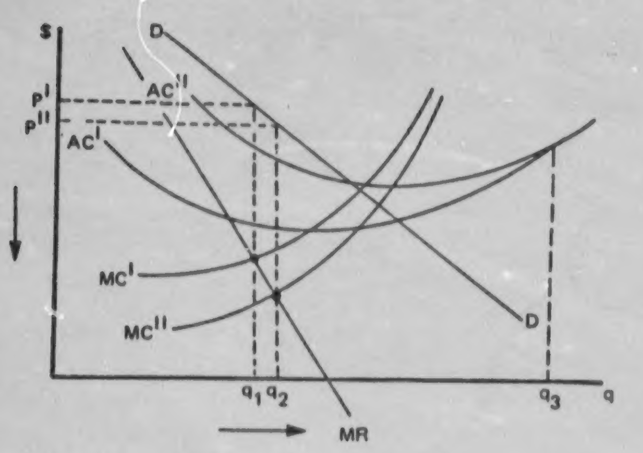
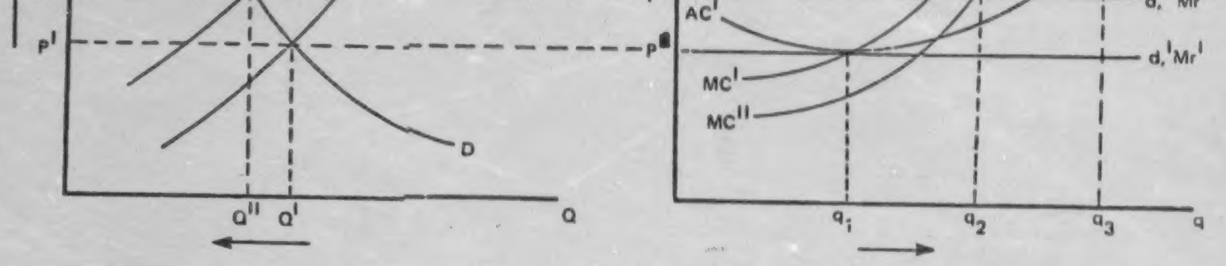


Figure 13
PURE COMPETITION – COST CURVES, OUTPUT, AND PRICE UNDER A MINIMUM LABOR USE REQUIREMENT



maintained through a technological change. Figure 14 illustrates the production function with a fixed capital-labor ratio shown as $\overline{OD}$. Again, this leads to a misallocation of resources as far as cost minimizing is concerned: F versus B for q_2, if the required capital-labor ratio, $\overline{OD}$ is to the right of the optimum expansion path, $\overline{OE}$.

If the optimal expansion path, $\overline{OE}$ is linear, as shown by Professor Simler, then the forced expansion path, $\overline{OD}$, will generate a higher total and average cost and a higher marginal cost.

$C' = P_K K + P_L L = P_K K + P_L \beta K$ where $\beta K = L$ for expansion path $\overline{OE}$.

$C'' = P_K K + P_L L = P_K K + P_L \alpha K$ where $\alpha K = L$ for constrained capital-labor ratio $\overline{OD}$.

Thus, $\delta C'/\delta q = MC' = \delta K/\delta q(P_K + P_L\beta)$ for β = constant

and, $\delta C''/\delta q = MC'' = \delta K/\delta q(P_K + P_L\alpha)$.

where, $\alpha > \beta$ for a binding capital-labor ratio constraint.

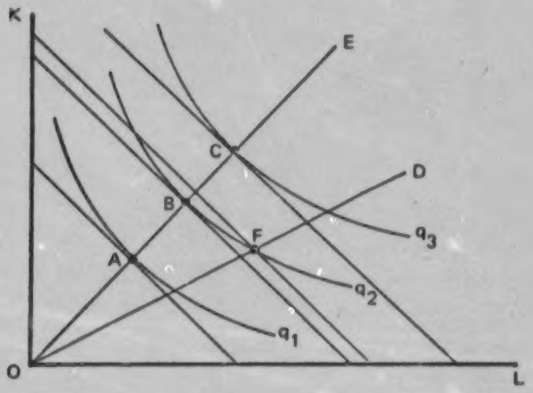
Therefore, $MC'' > MC'$.

If the expansion path is non-linear, then β will vary also, giving

$$\delta C'/\delta q = (P_K + P_L\beta)\delta K/\delta q + P_L K(\delta\beta/\delta q).$$

If the non-linear expansion path becomes more capital intensive, K/L increases, then $MC'' > MC'$ still and in fact, becomes greater. However, if the value of β increases along $\overline{OE}$, thus $MC'' > MC'$ may not hold over

Figure 14
PRODUCTION FUNCTION WITH AN EMPLOYER-EMPLOYEE AGREED UPON CAPITOL - LABOR RATIO - OD.


K
E
C
D
B
F
q_3
A
q_2
q_1
O
L

some output levels along $\overline{OE}$ (i.e., if $\beta > \alpha$ occurs, then the constraint is not binding).

When the marginal cost for the constrained capital-labor ratio, $\overline{OD}$, is greater than that for the optimal expansion path, the output will be lower and the price higher for both monopoly and pure competition industries; that is, for profit maximizing firms. Output will be less and price higher for firms using average cost pricing, regardless of the relative position of the marginal cost curves. If q_2, in Figure 14, is the optimal output, using the cost minimizing input combination at B, then some lower output than q_2 is very likely to occur with the imposition of the lower capital-labor ratio along $\overline{OD}$. The lower output will mean less employment only if the reduction in employment due to the lower output is more than the gain in employment caused by shift from the optimal expansion path, $\overline{OE}$, to the constrained capital-labor ratio, $\overline{OD}$; thus, the employment effect in the case of a maximum capital-labor ratio agreement is uncertain.

It has been shown that both labor use restrictions lead to a non-optimal capital-labor ratio if the restrictions are binding, and thus, to less cost efficiency in production. Another efficiency criteria is also affected in the imperfect competition sectors. This is the resource allocation efficiency concept of optimization where price equals marginal cost. It has been shown that both the price and marginal cost are affected by the use of restrictive labor policies. If the differential between price and marginal cost is narrowed (widened) in imperfect competition, then resource allocation is closer to (farther from) the optimum level.

5. Re-employment Aids

When lay-offs for some workers are required, various procedures may be imposed by unions and management to aid the displaced workers in finding new employment. Among these procedures are layoff notification, placement and referral systems. If the firm gives employees notice of layoff several weeks before actual termination, the forewarned worker may begin to seek re-employment, prepare to undertake retraining and/or adjust his expenditure pattern to accommodate a temporary break in regular earnings. By setting up job placement and referral systems, employers can provide labor market information to displaced workers and provide workers to employers who have job vacancies calling for the workers' skills. It is hoped that the worker will be able to shift more rapidly to a new job, and a better worker-job match will result.

Another method of aiding the re-employment of displaced workers is to place them on a preferential rehiring or hiring list. Those last laid off are the first recalled by a firm under the preferential rehiring system. Preferential hiring arrangements allow displaced workers to have first choice at new, similar jobs at other plants operated by their old employers or at other firms in the industry.

This system is attractive to workers, because it allows them a better chance of remaining in their old employment or regaining similar employment. By regaining employment with his old employer, the worker may continue to be eligible for the pension rights he has built up in the past. By continuing to work in the same industry with either his old firm or a new firm, the worker does not have to change occupations and, perhaps, unions. It may also be attractive to firms if they lay off workers in an order inversely related to their marginal products and then recall first those who were laid off last.*

Critics of preferential hiring or rehiring point out that the system causes workers to become immobile; that is, they wait for re-employment at their old place of employment rather than seek employment elsewhere. This represents a lessening of the resource allocation functioning of the labor market and may reduce efficiency in the system.

As discussed earlier, the vesting of pension rights may increase the speed by which a displaced worker seeks and finds re-employment in a different job, since he is not tied to his old employer through the pension fund. Early retirement funds may also aid the displaced worker, since he may retire temporarily from the labor force if employment opportunities appear slim at the time unemployment occurs. Thus, the early retirement funds may work as supplemental unemployment benefits and permit displaced workers to search for re-employment on a non-crises basis.

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*The author wishes to thank Professor N. J. Simler for drawing attention to this point.

6. Bargaining Procedures

The type of adjustment mechanisms available to workers and the specific impact of technological change can be influenced by the type of labor-management relations in use in the industry. Where labor unions and management are cooperating, attempts are made to allow management to introduce technological change with maximum flexibility in setting job requirements. This is allowed by unions in return for various aids to workers who are displaced such as supplemental unemployment benefits, attrition schemes, wider seniority, and relocation, preferential hiring, early retirement, minimum paygrade cuts, etc. For the remaining workers, shares in the increased returns from the technological change may be established by such things as higher wages, profit sharing, etc.

When labor-management relations are non-cooperative, the results may be work stoppages, restrictive work rules, restrictions against technological change and management efforts totally to eliminate the jobs of the troublesome union members. When this uncooperative attitude develops between workers and employers, and it threatens to harm the economy and society, the use of third-party arbitration may be advocated. Hopefully the third party will bring the sides together and help to show how cooperation will be beneficial to each group.

Other Public Sector Adjustment Mechanisms Including Education and Training Implications

In addition to the private adjustment mechanisms used by workers public programs and policies may also permit or enhance the success of workers' adjustments to technological change. The various public programs and policies may be classified into five broad groups: Aggregate labor demand policies, labor market information programs, education and training programs, work and income opportunities and union-management relations policies.

1. Aggregate Labor Demand Policies

The employment impact of technological change is obviously less in an economy experiencing full employment growth than in one suffering from slow-growth or no-growth problems. During strong economic growth, chances of being displaced are lessened, since most firms undergoing technological change would have expanding demand for their products or services. This increase in demand could partially or totally cancel out any reduction in employment involved in the production function change.

For workers who become unemployed, a rapidly expanding economy means more job vacancies and thus, a greater likelihood of securing re-employment without suffering a long period of unemployment or without having to undertake retraining or relocation activities. In the state of the arts section, reference will be made to several reports and to writers who feel that a full employment growth policy is essentially all that need be implemented by the public authorities to insure adequate adjustment of workers displaced by technological change.

Full employment policies involve a blend of fiscal policies, monetary controls, and income (i.e., wage and price) policies.[6] The impact of various combinations of these policies on the employment of different worker groups (by occupation, industry, age, sex, ethnic group and region), would need to be analyzed in relation to the amount of worker displacement likely to occur within each group, before any projections of re-employment could be made.

Regional, urban and rural policies may be used as the basis for implementing aggregate damand policies, or they may be instituted as complementary policies to aggregate programs. In either case, these more localized programs can take special problems of their areas into greater consideration than can national level programs. This means (conceptually at least) that the characteristics of the local labor force, especially those threatened by technological displacement, can be more closely identified and specific programs established to handle these potential labor-adjustment problems.

Besides the financial problems often discussed in establishing regional-urban-rural planning systems, a very serious problem is how to integrate and coordinate various local units. If each local unit goes its own way, the general equilibrium of larger regional units and of the national economy may be overlooked.[7] The danger is that local units will be forced, by lack of control over the larger economy and by their own self interest, to develop labor programs (education, retraining, relocation, etc.) and industrial development programs that are specific to the needs of their area. These may lead to a retarding of labor mobility at the national level and to general imbalances in supply and demand at the national level.[8]

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[6] Some authors argue that manpower programs fit in one or more of these groups. See, for example, Manpower Programs in the Policy Mix, ed. by Lloyd Ulmann, Baltimore, Md.: John Hopkins, University Press, 1973.

When other aggregate policies (fiscal, monetary, and income) fail to maintain full employment, the use of public employment programs has been advocated and was implemented in the 1930's and again in 1971, through the Emergency Employment Act (EEA). These programs have, perhaps, suffered in the public view due to being labeled "make work" or "government as the employers of the last resort" type programs; however, the EEA program provided monies for "real" jobs to meet local needs, and most of these jobs appear to have been in traditional areas of police and fire protection, sanitation and clerical work. Six months after the enabling legislation was passed, 140,000 workers were on the payrolls of state and local government, under EEA funds. Federal Reserve Board studies suggest that public employment programs such as EEA, may have twice the effect on reducing unemployment within a year that any other federal spending or tax cut program has.[9]

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[7] See, for example, Charles L. Leven, "Establishing Goals for Regional Economic Development" Chapter 29 in Regional Development and Planning, ed. by John Friedmann and William Alonso, Cambridge, Mass.: M.I.T. Press, 1964.

[8] The recently passed Comprehensive Employment and Training Act (CETA) will give the "fiscal federalism" concept the test since it consolidates all Department of Labor manpower programs into one package and gives the planning responsibility and financial means directly to the local governments (for communities ove 100,000 population) and to the separate states.

Finally, government legislation can affect the aggregate demand for labor (in terms of men not man-hours, by establishing basic work-week hours and retirement age requirements. Legal requirements for the pay of overtime for over forty hours of work per week may promote more employment, as may laws outlawing working more than some maximum number of hours per week. On the other hand, these measures may have a stifling effect; e.g., laws requiring payment of overtime for more than eight hours work per day may affect decisions as to the use of the four-day/ten-hour day production schedule. Governments as the employers of about one-sixth of the work force can help establish regional and national trends by changing their normal work week and vacation policies. By reducing the work week and enlarging the vacation time, the aggregate demand for labor may be enlarged.

By changing the requirements for Social Security benefits and by varying the actual benefits paid, the federal government can attempt to affect the labor-force participation of older workers and perhaps increase the demand for younger workers. Also, governments can influence private policies toward retirement by their mandatory age requirements for government workers and by changing the benefits of government employee retirement programs.

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[9] See, Public Employment Policies and Priorities, National Manpower Policy Task Force, 1819 H Street, Washington, D.C., December 1972, and Emergency Employment Act the PEP Generation, ed. by Sar A. Levitan and Robert Taggart, Salt Lake City, Utah,: Olympus Publishing Company, 1974

2. Labor Market Information Programs

Displaced workers may lack good information of the current state of the labor market; that is, workers may not know what type of jobs at what pay levels are available in various regions of the economy. The government financed Employment Security Offices serve as information sources for jobseekers and employers with job vacancies. This service, if effective, can reduce the search time for a person seeking employment and provide a better job match from both the worker's and the employer's viewpoint. Better job matches should result in fewer job turnovers from voluntary quits and dismissals. An active labor market information program should have current information on technological trends in various industries and be prepared to handle the re-employment problems of workers likely to become displaced. This information service could include counseling programs to provide workers with current labor market information, with testing services, and with direction toward retraining programs available. The information service should also make available information concerning the potential for re-employment through relocation.

3. Skill Development Programs, Education, and Training Implications

If technological change eliminates the need for certain skills in the economy, then some workers whose human capital consists mainly of those skills may need retraining in order to regain employment at a similar wage. The Manpower Development and Training Act of 1962 and the public employment program established under the Emergency Employment Act of 1971 specifically mention workers displaced by technological change as being among those eligible for funding. Public funded retraining and relocation has been discussed earlier, but some additional issues will be mentioned in this section.

One question is whether the present manpower programs are of much value to displaced workers; that is, if present manpower programs are geared more to supplying basic skills and improving the work habits of the disadvantaged, can they be of much value to experienced workers displaced by technological change? If the integration of displaced workers into programs set up for the disadvantaged is not feasible, then how can the technologically displaced be serviced? Are there enough displaced workers in a region to permit special programs to be developed for them locally or should they be brought together at a national training center? Should an individualized system be established utilizing home study, private tutors, apprenticeship, and/or existing vocational and general education facilities?

A second question is more basic and relates not only to retraining programs but to all vocational and general education programs as well. The question is whether greater emphasis should be placed on the development of job-specific skills or on the development of the ability to adapt to changes in the work and leisure environment during a lifetime? If the future is to be one of accelerating rates of change, with the continuous elimination of need for some skills and jobs and the development of new work activitites with new skill combinations, then training in only certain specific skills may be of value to the trainees only over the short run. Many studies which hold that the rate of technological change is accelerating emphasize the role of training and education programs in enhancing the individual's ability to adapt to his environment and to accept and adjust to change.[10]

Another part of this continuous technological change issue concerns the value of the actual skills being taught in skill training programs. Are these skills currently needed in the economy? Will these skills be needed over a long period of time or are they likely to be the next victims of technological change. This is the subject of the project for the N.S.F., R&D Assessment Program developed by Alan Fechter of the Urban Institute. That project details the problems encountered in attempting to foresee manpower needs as technology changes.

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[10] See, for example, Alvin Toffler, Future Shock, New York, N.Y.: Bantam Books, 1970, and Report of the Conference on Educational Priorities, "The Learning Society: Institution to Integrate Work and Education," Chapter 11 in The Future of Work, ed. by Fred Best, Englewood Cliffs, N.J.: Prentice-Hall, 1973.

4. Work and Income Opportunities Policies

The passage and enforcement of equal employment opportunities legislation may help the adjustment problems of some groups facing discrimination in the labor market, (e.g., Minorities, females and the aged who are suffering employment problems because of technologicaly displacement). If technological displacement has a relatively greater impact on the employment of specific groups who encounter hiring bias, fair employment legislation may help in two ways. First, it may increase the number of job opportunities available to them; second, it may help make them more secure in their present employment. The second effect would occur where the legislation outlaws discriminatory layoff procedures and enhances everyone's chances of receiving on-the-job training and promotion. The legislation could also help maintain the employment opportunities of all groups by prohibiting discriminatory union practices which could maintain a dual labor market favoring one chosen group of workers over others.

Unemployment benefits partially maintain an unemployed worker's income stream and help to provide for needed family expenditures while the individual seeks reemployment. The use of extended re-employment payments (EB) during periods of cyclical economic downturns and recession provide for further support to the laid-off worker and his family during periods of high unemployment and fewer job opportunities.

Proponents of the use of unemployment benefits to aid the adjustment of laid-off workers argue for wider coverage of workers, higher benefit payments and longer and more flexible use of extended benefits payments. It is argued that the longer payment periods and higher payments will allow the recipient to maintain his accustomed level of living and pay debts outstanding (mortgage, installment loans, etc.) without his undergoing severe hardships, and this will allow him to more adequately search the job market for a satisfactory job utilizing his skill and experience. This should provide for a longer term, more productive work experience and less job turnover than if the unemployed person had to accept some job hastily because of present financial hardships. Proponents argue that the payment of higher benefits for longer time periods also aids the aggregate economy by providing a floor to consumer spending which acts as an automatic stabilizer during periods of slow or no economic growth.

Opponents of higher and longer unemployment benefits (or in some cases of any benefits) argue that the payment, especially at high levels, may impede the efficient functioning of the labor market. The worker receiving high payments may not aggressively search for new employment, but may simply wait to be recalled to his old job. The worker may hold on to artificially high wage expectations and/or job expectations and keep searching the market rather than taking a more realistic view.[11] The worker may not

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[11] See, for example, Hirschel Kasper, "The Asking Price of Labor and the Duration of Unemplyment," Review of Economics and Statistics, May 1967, XLIX, 165-172.

The worker may not accept relocation as readily as he might have, even in the face of long-run declining employment opportunities in his present labor market area.

Much of the argument stems from the leisure-work tradeoff concept. Using the traditional approach, utility is a function simply of income and leisure, $U = F(Y,L)$, and income is derived from work, Y_W, and nonwork, Y_N, sources, $Y = Y_W + Y_N$. The tradeoff then concerns time used for work to produce income versus time used for leisure. The availability of nonwork income may cause a readjustment of the leisure-work time tradeoff. Opponents fear the nonwork income (unemployment benefits) may cause an option for full time leisure over work. This is shown in Figure 15.

Line $\overline{AT}$ represents the various income leisure time tradeoffs available to the individual given the wage rate he can command in the labor market.* With these possibilities he would choose point E_1 with Y_1 income, all from work, and L_1 amount of leisure time. T represents the total time (in hours) available during the time period used for the analysis (a day, a week, etc.) If opponents of high unemployment benefits are correct, the implementation of a nonwork income such as Y_2 by means

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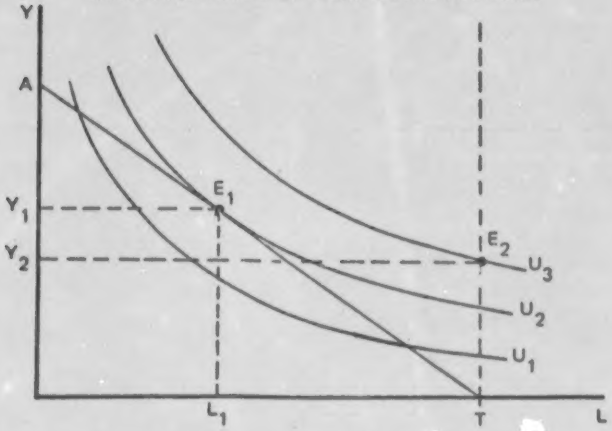
*A represents the income the individual could earn by working 100% of his time and is equal to the wage rate he can command, r times T or $Y = rT$ at A. In general if W is hours worked and L is leisure time, then $T = W+L$ or $W=T-L$, and total income $Y = Y_N + Y_W = Y_N + r(T - L)$. So $-r$ is the slope of the income-leisure availabilities line $\overline{AT}$.

Figure 15
WORK - LEISURE TIME TRADEOFF
WITH PRESENCE OF NON WORK INCOME.


Y
A
Y_1
Y_2
E_1
E_2
U_3
U_2
U_1
L_1
T
L

of unemployment benefits could cause the individual to opt for position E_2, which has all leisure time, zero work, but higher satisfaction for the individual involved. Thus, higher and longer duration of unemployment benefits could cause individuals to prefer leisure over work and reduce their job search efforts to the minimal necessary to retain the unemployment compensation.

Proponents of the use of higher payments for a longer duration may counter in several ways. First, the actual choice between work and leisure will be affected by the slope of the indifference curves so that the unemployment benefit, as long as it is somewhat less than work income, need not be more attractive (this would require redrawing of Figure 15). Second, the unemployment payments are not "forever"; and as an attractive job becomes available, the rational worker would be expected to take it in order to maximize his long-run satisfaction. Third, the utility function in this traditional approach gives zero utility from work itself and assumes no disutility (disgrace) from the continued receipt of nonwork income. The "puritan work ethic" would involve positive utility (satisfaction) from work itself, and disutility from nonwork income. This extension gives stronger preference to work over leisure than is shown under the traditional approach. Opponents, however, would counter that disutility from work is very possible (dissatisfaction with the job); and it is possible that for some individuals, at least, there could be positive utility gained from the receipt of nonwork income which would give more preference to leisure than to work.

Finally, the proponents of unemployment benefit payments would point out that the traditional concept is a static analysis which makes no allowance for lack of good labor market information or for lack of adequate job opportunities at the present time. That is, the suddenly displaced worker needs time properly to search the market to find out what is available in order to make a rational job choice. This search is costly in terms of direct costs involved in looking for a job (transportation, etc.) and in terms of needed expenditures that have to be maintained during the period of unemployment. If the economy is in a period of sluggish growth, no jobs may be available and some form of income maintenance would seem in order.

Of possible aid to displaced workers are the various income maintenance programs and proposals. These programs can be a short-run aid to adjustment, the income maintenance programs can work much as unemployment compensation; and it can be argued that one income maintenance system encompassing the unemployed would be more efficient to administrate. Income maintenance programs also offer long run compensation to the displaced worker and his family who simply cannot find re-employment or who need fairly long retraining programs. For the older worker whose skills are no longer needed because of technological change, some form of income maintenance may be the only answer. If private income maintenance programs are missing or viewed as inefficient, then public programs may be the best alternative.

A problem with income maintenance programs of the guaranteed income type is the effect on the individual's work-leisure tradeoff; that is, under certain conditions the guaranteed income payment may lead to the individual's choosing full-time leisure (as shown in figure 15). Figure 15, with Y_2 income as the guaranteed income, shows an income maintenance system where each dollar earned results in a dollar less in payment. This type of program is the most criticized as promoting non-labor force participation.

To promote "workfare" over "welfare" by giving incentives to seeking employment, various negative income tax schemes, such as President Nixon's Family Assistance Plan, have been proposed.[12] Essentially all these proposals involve a basic guaranteed income at a fairly low level plus a payment which varies from a maximum according to the level of income earned. Normally the income maintenance payment varies by some percent of income earned, (e.g., a loss of 50¢ of payment for each dollar earned until all of the welfare payment has been eliminated). In this manner the individual receives more total income by working than by full-time leisure.

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[12] See, Poverty Amid Plenty, The American Paradox, The Report of the President's Commission on Income Maintenance Programs, Washington, D.C.: U.S. Government Printing Office, November, 1969.

Figure 16 demonstrates the negative income tax approach to promoting work activity. T again represents the total time available during the given time period used in the analysis. Line $\overline{AT}$ represents the income-leisure tradeoffs possible without any income maintenance programs. Line $\overline{Y_2N}$ represents a guaranteed income approach and results in the individuals choosing full-time leisure at point N. Line $\overline{ABN}$ represents the income-leisure combinations available under a negative income tax system with a floor support of Y_2 and a maximum supported income level of Y_B. The income equation here is $Y = Y_W + (Y_2 - \alpha Y_W)$ for incomes below Y_B levels, where $1 > \alpha > 0$ and α is the percent of the income maintenance payment lost for earned income.* In Figure 16, the negative income tax leads to an equilibrium position at E where satisfaction is greater than with 100 percent leisure at N, $(U_2 > U_1)$.

Of course, a negative income tax system can also lead to full time leisure. This would be accomplished by shifting the utility curves to a greater (absolute) slope, so as to give the highest utility curve along line ABN at point N.[13] As discussed earlier, the utility and disutility

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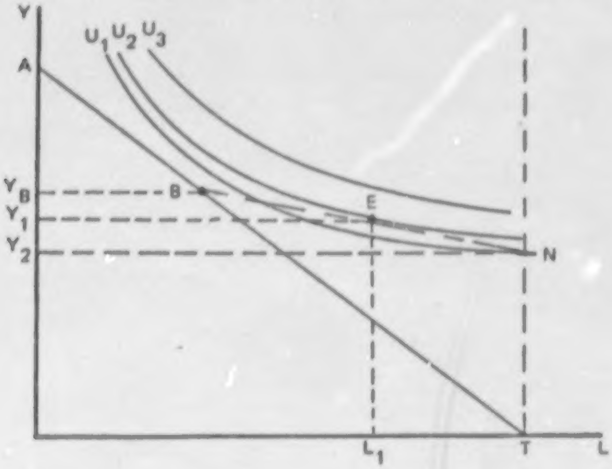
*For incomes below Y_B, i.e., where income maintenance is being paid.

[13] See, Office of Economy Opportunity, Preliminary Results of the New Jersey Graduated Work Incentive Experiment, U.S.G.P.O., 1970

Figure 16

NEGATIVE INCOME TAX IN THE WORK - LEISURE TRADEOFF.


Y
U_1 U_2 U_3
A
Y_B
B
E
Y_1
Y_2
N
L_1
T
L

from work, itself, and for receiving nonwork income subsidies have not been accounted for in this presentation.[14]

The special importance of income maintenance programs in aiding the adjustment of older workers displaced by technological change has been discussed several times in this report. The existing type of public retirement program, (i.e., the Social Security system) can aid older workers to the extent that workers are covered, that the age requirements allow retirement and that the income support levels make possible an adequate level of living by the recipients. This would need to include health care insurance as well as income and income-in-kind payments.

Lowering the minimum age of eligibility for optional retirement under the Social Security system would give more older persons the choice of retirement over attempting to find re-employment after being displaced. Raising the benefits paid and broadening the coverage of medical insurance would also make the programs more attractive and would provide for a better level of living for older workers forced out of the labor force. A possible problem here is the same one encountered in the unemployment compensation and income maintenance programs: older individuals, for whom regular employment still exists, may opt for full-time leisure and withdrawing from the labor force. Another policy issue in this area is whether special social security and retirement systems should be continued if a negative income tax program is established, or if the negative income tax program should also encompass the older workers and retired citizens as well.

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[14] For a study of the attitudes of low income families toward work, see, Leonard Goodwin, Do the Poor Want to Work? The Brookings Institution, Washington, D.C., 1972.

A final topic for this section on public policies for work and income opportunities is the possible use of minimum wage legislation to aid in worker adjustment to technological change. Minimum wages might be advocated in the case where technological change is eliminating high skill-high wage jobs and creating lower skill jobs, and when technological change is creating unemployment which could depress the wage rate in the competitive sector. This would give those who remain employed a better income security and make them more receptive to the idea of technological change which disrupts old job assignments and requirements. For those who are displaced but gain re-employment, minimum wages help maintain earnings closer to their old levels.

The broader policy issue is whether minimum wage laws significantly affect employment opportunities and inflation. The impact of minimum wage legislation depends on the level at which the minimum is established. and on the fraction of the work force covered. The higher the basic wage is set the greater is the number of jobs directly affected. Also, if any wage pyramids or differentials are based on the minimum wage, then the higher the minimum the greater the relative pyramiding of wage increases throughout the economy. If the full work force is covered by the legislation then the displaced have only two choices: remain unemployed while waiting for employment to increase, or drop out of the labor force. If there is an uncovered segment of the economy then a third choice may exist: accept employment at lower wages.

If the minimum wage is set above the equilibrium level in the competitive sector of the economy (as shown in Figure 17), then less labor employment results, assuming a ceteris paribus derived demand for labor. The higher wage level for the remaining workers may however affect the aggregate demand for goods and services which increases the derived demand for labor to, say D^1D^1, which as drawn, restores employment to the old level of L_E but still leaves some involuntary unemployment, $\overline{AB}$. Both impacts of minimum wage legislation must be considered in estimating the employment impact of the law.

In the imperfect competition sector, the same impact of minimum wage legislation must be analyzed, including the possible existance of discontinuous labor demand curves for which no change in labor demand would occur. That is, if the firm has a discontinuity in its marginal revenue function because of a kinked demand curve, or a discontinuity in its marginal productivity of labor function because of a linear production function or capacity production, then the firms' derived demand for labor function is discontinuous over a wage range and results in constant demand for labor over this range regardless of the wage level (see Figure 18). The result here is the same employment level with higher wage rates (W_M W_E), and thus, probably greater consumer spending and a shift

Figure 17

MINIMUM WAGE IMPACT ON EMPLOYMENT

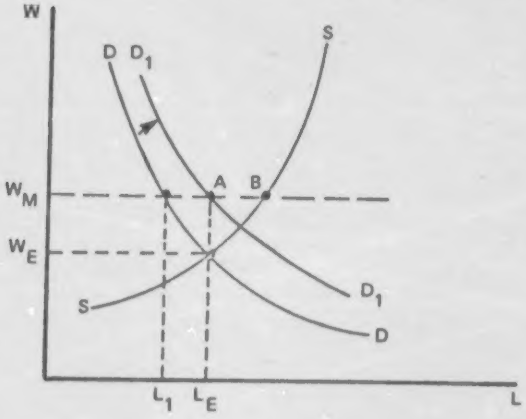
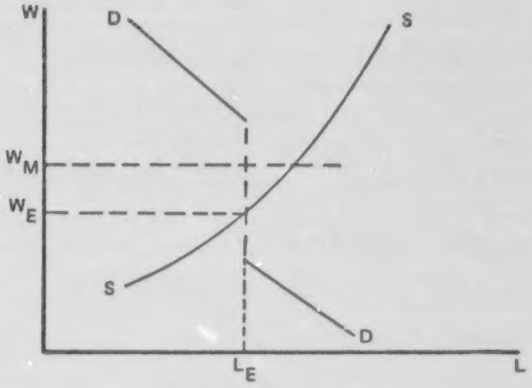


Figure 18
DISCONTINUOUS DERIVED DEMAND FOR LABOR



in aggregate demand and thus, in the derived demand for labor (as shown in Figure 17).

The shifting of minimum wage levels may lead to higher unit labor costs which are passed on to the consumer in the form of higher prices, thus partially or wholly negating the real effect of the minimum wage change. In industries using average cost markup pricing (such as price increases based on cost increases as under the price control board), the higher wage could result in price increases greater than the wage change due to the pyramiding of price and cost markups from manufacturer through the wholesaler and distribution channels to the retailer.

Increases in minimum wages may benefit individuals who keep their employment or find re-employment, depending on whether or not the higher wage produces relatively greater price increases; also, the higher minimum wage may decrease or increase employment opportunities depending largely on the effect the higher wages have on consumer spending and aggregate demand. If the minimum wage leads to a significant inflation of prices, this may create other economic problems and hardships which must be faced by the policy maker.

5. Public Policies toward Union-Management Relations

Technological change may necessitate a change in government policy toward union-management relations and collective bargaining procedures. Additional government intervention may be necessary if collective bargaining breaks down in attempting to handle technological change and severe work stoppages occur. Intervention may become necessary if the type of arrangements being reached in private collective bargaining are deemed to be detrimental to society's welfare in the short run or long run (e.g., the stifling of economic growth).

Three possible forms of public intervention into the collective bargaining process are public representation, legislation covering bargaining areas, and compulsory bargaining. If collective bargaining is breaking down in the face of technological change, then perhaps public representatives acting as mediators may bring about agreements, or perhaps, compulsory bargaining with no or limited work stoppages will have to be implemented. If collective bargaining is arriving at agreements viewed as less than optimal for the total economy and society, then maybe the presence of public representatives at the bargaining session will lead to more satisfactory results: maybe legislation detailing the limits of collective bargaining agreements will be needed.

Legislative acts have greatly facilitated and shaped the development of union-management relations over the last few decades. In terms related directly to labor adjustment to technological change, the two points made earlier concerning public involvement in the bargaining process can be made more specifically, First, is collective bargaining functioning well in aiding the labor adjustment problem? If not, can some sort of public representation, new legislation or compulsory bargaining change this process so it does work better as an adjustment tool? Second, if the collective bargaining is functioning as a labor adjustment mechanism, is it the best approach from the viewpoint of the individuals who are involved and from society's viewpoint? If not, can public involvement produce better results or will it just prove a further source of strain and discord which hampers the adjustment process?

CHAPTER 3

OTHER RELATIONSHIPS BETWEEN WORKERS AND TECHNOLOGICAL CHANGE

Impact of the Supply of Labor on Technological Development

In the preceding chapters, the impact of technological change on the supply of labor has been discussed. In particular the impact of technological change on skill development, training and education requirements for private and public programs was discussed in the preceding chapter. The purpose of this section is to reverse this causality and look briefly at how changes in the supply of labor can affect the rate of technological development.[1]

The rate of technological change may be slowed because of lack of workers having the skills needed to implement the new innovation in production. If this occurs the employer must decide whether it will pay him to also undertake the cost of training the needed workers or whether it is better to put off the investment at least for the present. If the training involves a substantial time period or if the innovation is put off because of lack of skilled workers, then a differential exists between the level of technology known or in existence and the level of technology in actual use. This technology gap can be closed or narrowed if the proper skill mix or a better skill mix is developed. Thus changes in the supply of labor may affect the rate of innovation by allowing new technologies to be brought into use.

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[1] Material in the first part of this section is drawn heavily from R. R. Nelson, and E. S. Phelps, "Investment in Human, Technological Diffusion and Economic Growth", American Economic Review, May, 1966, pp. 69-75, and F. Welch, "Education in Production", Journal of Political Economy, Jan/Feb. 1970, pp. 35-59.

Welsh, and Nelson and Phelps have pointed out that the impact of the labor supply on the rate of technological change may be more than just the restrictive impact discussed above. The quality of workers may also influence the rate of technological innovation by their ability to promote and adapt to change. That is, part of the better quality embodied in a more educated worker may be the individual's ability to adjust quickly to change and to introduce innovative changes himself. More educated workers may more quickly make use of presently known but unused technology and may also help cause the rate of technological change to accelerate.

Welch points out that more educated workers may be much more valuable during periods of rapid change when good information concerning the most efficient production methods is scarce, because they can pick out the more efficient methods faster. "If educated persons are more adept at critically evaluating new and reportedly improved input varieties, if they can distinguish more quickly between the systematic and random elements of productivity responses, then in a dynamical content educated persons will be more productive."[2]

From the policy maker's viewpoint two basic issues appear. First, as adjustment mechanisms work better (e.g., better labor placement, better retraining, better education), then the rate of technological change may accelerate due to the technology gaps being closed and due to better workers promoting further technological growth. Second, if more rapid technological change does occur as a result of better education and training, and if technological change is creating substantial labor adjustment problems, then this educational upgrading may be amplifying the problem, at least in the short run. The creating of better labor adjustment mechanisms may generate problems for more people and necessitate greater reliance on adjustment mechanisms.

A second way in which the supply of labor may possibly affect the rate of technological change in a firm or industry is through the impact of unionization. If unionization brings with it higher wages, this, in static economic analysis, will lead to a substitution of capital for labor over the long run. . The question of concern in this study is what influence, if any, does the higher wage rate have on the rate of technological change in those industries. It may be argued that the higher wages spur a more rapid rate of technological change for two reasons: First, in order to compete and make a reasonable profit when faced with higher wage costs, the firms may attempt to increase productivity and lower unit cost, by improving the quality of the capital and the efficiency with which the inputs are combined in the productive process. Second, the higher wages will allow the firm to attract a more skilled, better educated work force (or perhaps persuade the firm to upgrade the present work force via on-the-job training), which may then accelerate the rate of technological growth as discussed above.

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[2] A. Welch, Education in Prod., p. 74.

Impact of Technological Change on Worker Attitudes, (Psychological, Sociological, Familial Consequences).

The preceding material has concentrated on the economic aspects of the relationship between technological change in jobs and worker adjustment. First, discussions of the possible effects technological change can have on the production function, cost function, output level and hence, on labor demand, were developed. Next, conceptual discussion of various private and public funded or aided worker adjustment mechanisms were presented where the main concern in adjustment was economic matters (e.g., jobs, income, skills and education for work). The adjustment mechanism chapters contain the basic material for this report and were given the most detailed attention. The preceding section reversed the procedure and discussed how the quality of the labor force could affect the rate of technological change and thus the economy.

In this section brief mention is given of how technological change can affect workers, their families and society's welfare in other than purely economic ways. How does the worker react sociologically and psychologically to technical change and any disruption brought along with it?* How does his attitude and outlook on life change? What happens to the relationships within the family, and how does this feedback on the worker's performance, job search, etc.? These matters can obviously have strong economic implications as they affect the worker's performance on the job, his attitude toward work in general, and his attitude toward collective bargaining.

For the displaced worker who becomes unemployed for a long duration, questions concerning the impact on family relationships are of vital concern when measuring changes in individual and societal welfare. What happens when the household head no longer is the "breadwinner" and other family members take over the income-producing roles or welfare becomes a way of life? How is the individual's emotional stability affected: How does the family readjust to the new situation, and what are the sociological implications of these changed and, perhaps, strained relationships?

For those displaced workers who find re-employment, what does the shock of the adjustment to a new job and maybe to relocation do to the worker and his or her family? If the new job carries a lower wage, how does it affect the family, not only economically but emotionally, as they have to adapt to a new lifestyle and maybe develop a new peer group? If the family moves what types of strain does this produce, and how are the children affected by the uprooting and forced changing of schools and friends? How are the family's feelings of security affected over the long run by the loss of a job by displacement? Do they now live with greater fear of recurring job loss and income interruptions; if so, what does this do to their mental and emotional well-being? A question that is directly related to our study concerns the impact on these various problems of different types of adjustment mechanisms. Are some adjustment mechanisms more favorable with regards to their psychological and sociological results?

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* A more detailed study of worker alienation related to technological change is being conducted by Barbara Burns of the N.S.F., R&D Assessment Program staff.

If the technolocially redesigned job or the new job found after displacement is considered to be less desirable and/or less interesting, what effects will this have on the worker's social well-being (i.e., the mental and emotional effects). "...The only happy people I know are the ones who are working well at something they consider important ..."[3] "Especially healthy and stable self-esteem (the feeling of worth, pride, influence, importance, etc.) rests on good, worthy work to be introjected thereby becoming part of the self."**

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[3] Abraham Maslow, "A Theory of Human Motivation: The Goals of Work," p. 26, Chapter 2 in The Future of Work ed. by Fred Best, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1973.

*Ibid., p. 27.

These Psychological effects are important from the narrower economic viewpoint since they may result in increased worker alienation which lowers worker productivity, affects the quality of the good or service produced, and may affect union-management relations. Many writers are concerned with technology's being used to implement more and more machine controlled tasks without regard to the effect on the worker. It is "...necessary to recognize the primary of the whole human being, to adapt the work to the man ... human psychology reacts directly upon productivity. When the worker feels that he is in a hostile environment and in an economic system opposed to his interests, he will not work...with the same ardor and skill."[4] If technological change and the resulting adjustment mechanisms establish basically more boring, uninteresting jobs which increase worker alienation, then economic growth and production may be affected and social well-being lowered economically, psychologically and sociologically. Thus labor adjustment mechanisms which help maintain the job status and respect for the worker may enhance the gains from technological change by overcoming potential labor alienation problems.

Collective bargaining and other labor-management relations may be affected by the mental and emotional reactions of the workers to technological change. The state of the arts section will review several authors' views of the relationship between technology change and attitudes toward collective bargaining. One basic view is that the change is destroying unions by destroying workers' interest in their jobs, by making them less secure in their jobs, and by creating friction between leaders and members and between older and younger members. Another and somewhat opposite view is that more militant worker reactions will occur (e.g., more wildcat strikes and greater demands for work rules) as workers seek greater security through union action. Both views, however, see union-management relations changing because of psychological as well as economic impacts of technological change.

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[4] Jacques Ellul, "Misused Technology: Humanity as a Cog in the Machine," pp. 125-26, Chapter 15 in The Future of Work, ed. by Fred Best.

A view expressed by many "futurists" is that technological change will lead to an economy of abundance,[5] where the amount of work time will be greatly diminished, leaving more and more hours of freedom. How will individuals and society adjust to shorter hours of work for fewer days per week, to greater amounts of vacation time and holidays, to more years of retirement? Will work become a more important or less important aspect of our lives?

> The values surrounding work, which in the developed areas have evolved over centuries, may emerge into a new flux and once again become controversial sources of problems within a society and for many individuals. the ideologies that surround work and give it justification and value, in individual and social terms, may become strengthened in support of what remains of work; on the other hand, they may increasingly come into doubt and become the objects of reaction and rebellion.[6]

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[5] These "abundance" concepts may be in the process of review given the current energy problems and in light of such studies as, The Limits to Growth, Donella H. Meadows, et. al., New York, N.Y.: Universe Books, 1972.

[6] Herman Kahn and Anthony Wiener, "The Future Meaning of Work", Some "Suprise Free" Observations," p. 145, Chap. 14 in The Future of Work, ed. by Fred Best, Englewood Cliffs, N.J.: Prentice Hall, Inc., 1973

The consequences of these types of changes would depend on the types of benefits people derive from the work role ". . . status; sense of striving; feeling of productivity, competency, and achievement; and relationships with others and advancement in a hierarchy, whether organizational or professional.* The type of adjustment mechanisms advocated and adapted obviously can greatly affect this potential problem, since shorter hours and early retirement have been commonly discussed adjustment mechanisms. As pointed out above, other types of adjustment mechanisms would also affect the role of work and its benefits to the individual.

Finally, mention should be given to those people who feel the whole concept of enhanced technological growth for greater economic growth of material output with a resulting magnification of the corporate structure and corporate man is wrong, that it is lessening well-being for the individual and society. The suggested alternative "adjustment mechanism" is to reject the trend as they foresee it and to accept an alternative lifestyle based less on income levels and less on working in a large organizational framework. This is the counter culture idea[7] which sees freedom coming from other directions than those now present in our economy and society.

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*Ibid., p. 151

[7] See, for instance, Charles Reich, The Greening of America, New York, New York: Bantam Press, 1970.

"They don't want to work at meaningless jobs--producing junk or shuffling a corporation's bureaucratic papers in order to buy more stuff. . . They want to be free men and women. And to be that, they are willing to be poor: to drop out. . . and instead try building up a lifestyle that will suit them."[8]

This alternative adjustment or "revolution" sees much of technological progress as being illusory. According to this school of thought technological change has often been harmful to the individual and society psychologically, physiologically, sociologically and, over the long run, economically. They feel all innovations need to be subjected to close scrutiny before being unleashed on humanity. "If a new device contributes to the ugliness, impersonality, dirt, heat, noise, garbage and air pollution of the world, we ought to reject it."[9]

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[8] Ernest Callenbach, "The Counter-Culture Thrust: Living Poor With Style," p. 162, Chapter 16 in The Future of Work ed. by Fred Best.

[9] Ibid., p. 166.

CHAPTER 4

ADJUSTMENT MECHANISMS AND SOCIAL WELL-BEING

Introduction

The objective of this chapter is to use the tools of welfare economics to present some general relationships between the various types of adjustment mechanisms discussed in earlier chapters and the level of societal welfare. The purpose of policy is assumed to be to increase well-being in general, not only in one dimension such as economic welfare. This means that qualitative judgements must be made and weighed along with quantitative judgements for all possible factors associated with social well-being. It is hoped that this discussion will tie together the various concepts discussed in the preceding sections of this report in such a way that readers contemplating and/or advocating policy making to aid worker adjustment to technological change will broaden their perspective to take in the widest possible view.

Welfare economics includes ethical or value judgements (or "qualitative judgements" as stated above), and this emphasis on more than only objective, technical concepts is of vital concern. To attempt to reduce the basis of welfare economics or policy making to measurable, quantitative relationships only, would dehumanize the process by ignoring many of the real factors which affect individuals' feelings of well-being. Thus, this opening statement may be taken as a reminder that our decisions concerning what is the best combination of adjustment mechanisms for society to use will be laden with value judgements that must be dealt with and not ignored. "Getting rid of value judgements would be throwing the baby away with the bathwater. The subject is one about which nothing interesting can be said without value judgements, for the reason that we take a moral interest in welfare and happiness."[1]

The policy advocates' scope of reference must take into consideration the external effects of private adjustment mechanisms and the impact that public adjustment mechanisms have in facilitating or hindering improvements in social well-being. The use of various adjustment mechanisms may decrease the level of uncertainty concerning the welfare effects of technological change and thus increase individuals' willingness to accept change. The introduction of new adjustment mechanisms may, however, change old social institutions which are sources of utility for some individuals and affect well-being in another dimension.

Technological Change, Work and Welfare

We can begin with the most basic type of assumptions, such as that society is producing on the production possibilities frontier (i.e., no unemployed resources) and, before the technological change, that it is producing that combination of outputs which is maximizing total welfare. A technological improvement occurs, shifting the production possibilities curve outward (i.e., more output attainable from the same set of inputs). Under the most simple optimizing assumption society would move in a Pareto optimal manner to the new production possibilities frontier and have more output and a higher level of welfare (i.e., a move in which at least part of society is better off and no one is worse off). Now many of the simplifying assumptions will be dropped as we discuss the reality of the possible changes that occur in output and welfare as technology varies and different adjustment mechanisms are used in the labor market.

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[1] I.M.D. Little, A Critique of Welfare Economics, 2nd ed., London, Oxford University Press, 1957, p. 80

Any move due to technological change from one output combination on one production frontier, to a new output combination on a new production frontier, means the production function for one or more products has been changed. This means that possibly the skill mix needed in production has varied or that the content of many jobs has been altered. If either or both of these events occur, then the welfare of some workers may be diminished, even though they remain employed.

Worker well-being may be lowered because of decreased earning power after the change due to a shift in demand for various skills. If occupations are changed then absolute real earnings may be changed with some workers becoming worse off and some better off. If this occurs, then the increase in output under the new technology could not be proved to have increased welfare without some sort of weighing of the improvements of the gainers relative to the losses of the losers. Allowing "the market to work" could easily give this result; and if it is correctly forecasted by the potential losers, they may work to stop the change or delay it (with inflexible work rules, attrition schemes, etc.)

Basically a shift of the type described above gives a windfall loss in the return to human investment for these individuals whose incomes are reduced and may require further retraining costs for a new occupation while giving windfall gains to others. For society these windfall gains and losses may balance out in favor of the gainers and be a plus to net economic welfare; but, for the individual, the windfall gains and losses do not cancel out because an individual does not have an extensive portfolio of investments in human capital. However, one type of adjustment mechanism--education and training which aids in accepting and rapidly adjusting to change--may help provide an "investment hedge" in human capital.

The technological change could increase output but leave society off the Pareto optimal contract curve. Here Pareto optimal moves to the contract curve are possible within the context of the new real incomes of the individuals. Private adjustment mechanisms may or may not facilitate a rapid move to the contract curve, because of poor information, misconceptions of what the move would entail, etc. Public programs then might bring about a more rapid movement to the contract curve, somewhat improving the welfare of each individual; however, this type of Pareto optimal move is within the context of the new state of technology and reveals nothing about the equity or welfare of the final real income distribution as compared to the one that existed before the technological change occured.

In addition to changes in welfare due to shifts in real earnings of workers, technological change may also change workers' welfare by changing job duties and activities. That is, if workers receive satisfaction (or dissatisfaction) from work itself, then technological change which varies job content may cause workers' welfare to vary. In this case worker well-being could be lowered, even though the purchasing power of all individuals is increased, because of changes in job activities "...it is often better to weigh up any improvement or deterioration in his position as a consumer against any deterioration or improvement in his position as a worker..."[2] (At this point we are still assuming independent utility functions; i.e., no interpersonal comparisons or relative status.) Utility derived from work itself would rule out utility based solely on the amount of income received, since welfare is (more realistically) based on more than ability to purchase goods and services.

This relation between actual job duties and welfare means that welfare studies based on the neoclassical view of the production function as an engineer's view of the best technical efficiency standards[3] must be discarded. Meaningful welfare analysis can be developed only if worker satisfaction from his actual job duties is incorporated into the model; that is, the external costs and benefits to the workers of any production technique must be considered along with the internal costs and benefits to the firm. Recent experiments by the Swedish auto makers Saab and Volvo in team construction of a complete auto have been based on the belief that worker dissatisfaction with the assembly line technique has become so great that, perhaps, it has actually lowered worker productivity below that possible with the use of the team construction technique.

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[2] Little, Welfare Economics, p. 46.

[3] For example see, Tibor Scitovsky, Welfare and Competition, revised ed. Homewood, Ill.; Richard D. Irwin, Inc., 1971, pp. 480-1.

Two more points relative to technological change can be made in reference to welfare analysis based on the use of the basic Pareto optimizing and production frontier concepts. First, as pointed out in the section on "technological change and demand shifts" in Chapter 1, the actual shift in methods used in producing a good or service may cause the consumer's perception of the quality of the product to vary. This would alter the utility functions of individuals and the welfare functions and could cause a decrease (or increase) in feelings of well-being in the society. Second, a substantial change in job activities, earnings, consumption patterns, etc., brought on by technological change may alter a person's tastes or utility function. This would further complicate the analysis of the change in society's welfare, because the shift in each individual's utility function must be allowed for in the analysis before any comparison of net gains and losses in welfare for society as a whole can be attempted.

Technological Change, Efficiency, Employment, and Growth

At this point, the assumption that no interpersonal comparisons are made by individuals when calculating their welfare will be dropped. This appears to be a more realistic approach since "... comparisons of real income must be, in part at least, of mental states or changes in mental states."[4] And as Professor Little points out, mental states are affected by interpersonal comparisons which must be expected to occur.

Thus, the distribution of income may shift as technology changes and a higher production frontier is reached. This shift in relative income shares may then cause some individuals to feel worse off (have a lower level of welfare). This can occur even if the absolute level of income has increased for everyone. If one group has not received as proportionately large a share of the increase as another group has received they may feel they have not received their fair share. These individuals might feel they have been left behind in the growth process and are now on a relatively lower scale in society. This may well induce feelings of decreased well-being or welfare. Proposed adjustment mechanisms may flounder because inadequate attention is being given to the relative share of the gains going to the different groups of workers, even though the mechanism improves the absolute real income level of all workers. This is an important consideration since one of the often expressed goals of labor unions is to get a fair share of the income for labor.

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[4] Little, Welfare Economy, pp. 55-6.

The introduction of interpersonal utility comparisons allows for the possibility of society's not being able to reach the new production frontier and still be maximizing welfare. Here the welfare optimizing process may lead to unemployment of economic resources or to "inefficient" combinations of inputs and outputs. Several other ways in which technological change may lead to unemployed resources will be discussed later in this section.

The "inefficiency effect" is shown in Figure 19 as developed by J. de V. Graaff[5] in a discussion of the presence of external effects in consumption. These external effects may arise from the interpersonal comparisons of income or earnings (as discussed above). T is a production transformation curve for input X and output Y. BB is a welfare surface without interpersonal comparisons which gives a welfare optimizing point M for society where all the normal marginal equalities hold. Curve B^1B^1 represents a welfare frontier which may occur if interpersonal comparisons are allowed for in the analysis. Here an infinite number of optimum positions are possible, only one of which is on the production frontier, all others are "inefficient" combinations in technical possibilities terms. Thus, for the existing methods of distributing the output gains, it does not increase welfare to increase output from a given levels of input usage.

This is another possible reason to explain the use of adjustment mechanisms such as inflexible work rules, attrition schemes and others

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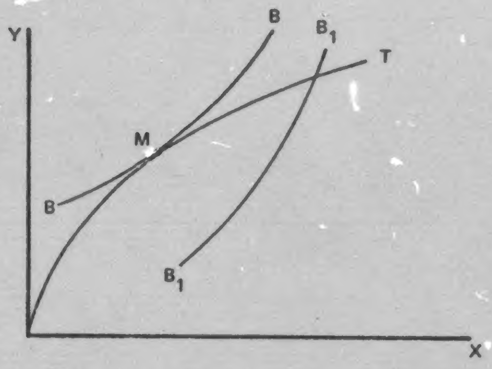
[5] J. de V. Graaff, Theoretical Welfare Economics, London: Cambridge University Press, 1967, pp. 58-9.

Figure 19
WELFARE OPTIMIZATION WITH INTERPERSONAL COMPARISONS OF UTILITY


Y
B
B1
T
M
B
B1
X

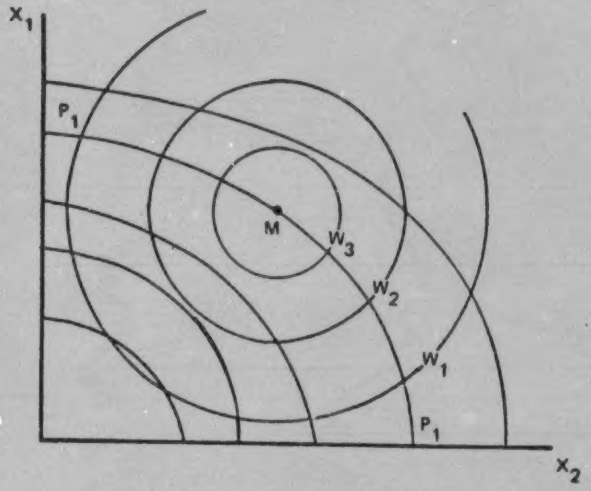
which appear to restrict output below its potential by not allowing the "best technical" combination of inputs and outputs. Policy makers may attempt to alter this type of outcome by generating adjustment mechanisms which maintain worker welfare while allowing for greater output from existing inputs; that is, to more fully utilize the output potential present in existing technological knowhow. As will be discussed later, however, individuals may draw welfare from the actual form of social organization; and to change this social organization with new government interventions and/or changed labor-management relations may decrease the welfare of some members of society.

The type of adjustment mechanisms used by labor and management and introduced by government obviously may have significant impacts on the increase in the production possibilities in the short run and in the direction and the rate of growth of the production frontier over the longer run. Early retirement, attrition schemes, seniority, guaranteed annual wages, supplemental unemployment benefits, changes in hours of work, relocation, retraining programs and work rules all affect the quantity of manpower and the quality of manpower available in the economy (regionally, and by industry and occupation), which affects the level of productivity and the composition of output in the short run and long run. These adjustment mechanisms, then, determine or influence the actual output in relation to the technically potential production frontier in the short run and also influence the growth of the production frontier over the longer run by affecting the type of manpower inputs available (skill levels and mix) and the expected rates of return on investment.

Normally it is assumed that increases in output and, hence, in real economic income are desirable; that is, increases in economic output are usually assumed to bring about greater levels of welfare in society. Thus, adjustment mechanisms which threaten to stop or slow economic growth may need public attention. However, as shown in Figure 20 and discussed above, economic growth may not increase welfare. In Figure 20 the welfare contours form a hill which peak at M; thus the maximum level of production which could optimize welfare is shown by the production frontier P^1P^1 would, in this example, decrease social welfare due to external effects of extra production. While there appears to be a high correlation in most economies between levels of output and feelings of well-being, it should be remembered that the relationship may be an inverse one at times.

Related to this discussion of the growth of the production frontier is the effect technological change coupled with various types of adjustment mechanisms have on the work-leisure tradeoff and thus, on production possibilities. The production frontier is based on a given amount of inputs , (including labor) being combined in the production process, using a given level of technology; however, the amount of labor available may change as technological change results in changes in the relative wage

Figure 20
ECONOMIC GROWTH AND SOCIAL WELFARE


X$_1$
P$_1$
M
W$_3$
W$_2$
W$_1$
P$_1$
X$_2$

rates, and hence, in the attractiveness of various occupations and leisure. Adjustment mechanisms which affect earnings and non-work income may alter the work-leisure tradeoff decisions. As choices of relative occupations and work time versus leisure time vary, this will affect the rate and direction of growth of the production possibilities surface.

At this point, another step towards a realistic model can be taken by introducting the possibility of unemployment existing in the system. Technological change may lead to increased unemployment in at least some occupations, industries, or regions. Immobility of labor, inability to adapt to change and get retraining, discrimination, monopoly power and income distributions leading to insufficient purchasing power may all result in the economy operating off the production frontier (i.e., with some unemployment). Technological change may increase the problem in some areas. If welfare is maximized by attaining an equilibrium on the production frontier, as is normally assumed, then failure to reach the production possibilities surface also implies non-attainment of the potential welfare frontier.

Since all the institutional imperfections do exist which make attainment of the competitive equilibrium on the welfare frontier impossible, J. de V. Graff argues that the locus of points which represent the actual welfare positions society can reach, given the institutional constraints present, should be the surface of most immediate interest. This locus of welfare positions he terms the "efficiency locus."[6] Changes of various kinds in the system may shift the welfare frontier and efficiency locus in the same direction or in opposite directions, or may twist (change the slope of the curve) one or both of the curves. "For instance, an invention which shifts the frontier outwards may confer on the innovators monopoly power so great the efficiency locus is given a twist, or even shifted inwards."[7] In a like manner, adjustment mechanisms may improve (shift outwards) the efficiency locus or they may cause the locus to shift inwards by giving one group more at a considerable real cost to others in society.

The presence of imperfect institutions on the producer side and in the labor market destroys the competitive efficiency arguments on which attainment of the welfare frontier through market mechanisms rests. To reach a maximum efficiency position in this environment, Scitovsky argues that bargaining between labor and management is needed.[8] Thus, the development of private adjustment mechanisms based on labor-management agreements is seen as being required in order for efficiency to be reached in an imperfectly competitive economy. J. de V. Graff has presented similar arguments which would support the "efficiency" of adjustment mechanisms, public and private, even if the mechanisms created situations in which the real price of labor was not equal to its marginal product. "It seems fairly clear that the conditions which have to be met before it is correct (from a welfare viewpoint) to set price equal to marginal cost in a particular industry are so restrictive that they are unlikely to be satisfied in practice.[9]

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[6] J. de V. Graff, Theoretical Welfare Economics, p. 76.

[7] Ibid., p. 85.

[8] Scitovsky, Welfare and Competition, p. 472.

If the private adjustment mechanisms are keeping the actual welfare below that possible, then government policy such as legislative constraints on the terms covered in private agreements, compulsory bargaining, and/or public representation may be beneficial to society. The policy makers "...can consider the further question of altering institutions in a way which will improve the allocative efficiency of the economy so as to make the efficiency locus approach closer to the frontier."[10]

In situations where technological change has created substantial unemployment, the usual assumption that it is best to select those production techniques and projects which get the most output from the least input may be discarded as nonoptimal from a welfare viewpoint. Private adjustment mechanisms such as attrition schemes, guaranteed wage systems and work sharing, and public programs to promote employment may help push the economy to a higher level of welfare. In this situation the greater employment would be seen as a benefit to society because of maintaining incomes, maintaining work values, etc. "Given this judgement, ... it is possible to prefer a certain project B when it requires the same amount of all inputs as A. but more of labour. Thus A may be technically more efficient but B may be preferable."[11]

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[9] J. de V. Graff, Theoretical Welfare Economics, p. 154.

[10] Ibid. p. 85.

Policy Making and the Level of Welfare

The preceding sections have outlined several reasons, in relation to technological change, which reject the idea that our economy can move in a Pareto optimizing fashion (at least one person better off, no one else worse off) to an equilibrium position where the community welfare frontier is tangent to a production frontier. These reasons included interpersonal utility comparisons, utility derived from work itself, monopoly power in business and labor, and unemployment resulting from imperfect factor mobility and improper distribution of incomes to maintain aggregate demand.

All of these lead to the possibility, in a realistic model on which public policy must be based, of changes occurring in the economy which make some individuals better off and some worse off. Thus, the policy maker may often be faced with the dilemma of facilitating technology change and adjustment mechanisms which requires weighing the gains in welfare for some members of society against the losses in welfare for other members of society. One method by which this issue may perhaps be overcome is the compensation principle. "...We might try to evade this judgement on welfare distribution by the conservative principle of compensated adjustment. We must suppose, ..., that any degree of welfare redistribution is feasible, and on this principle, redistribute in order that no one is left worse off, though some are better off,..."[12] Many private adjustment mechanisms appear to be based on this approach (e.g., supplementary unemployment benefits, vesting of pension rights, profit sharing, guaranteed annual wages, shorter workweeks with no loss of income, early retirement, etc.). Where these private adjustments appear to be working in the best interest of the public at large, the government policy may need largely to consist of measures to improve the speed at which these agreements are reached. In areas where private mechanisms do not appear to be working well, the public policy may attempt to compensate potential welfare losers (e.g., with extended unemployment benefits, relocation allowances, retraining and income maintenance programs). When compensation is impossible, then the difficult task of analysing and summing net changes in an individual's welfare is required.

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[11] Amaryta K. Sen, "The Role of Policy-Makers in Project Formulation and Evaluation, "U.N. Industrialization and Productivity Bulletin, #13, p. 26.

Attempts to compensate adequately or to estimate net changes in community welfare when compensation is impossible are loaded with problems. No quantitative tools are available by which changes in welfare for all members of society can be weighed and summed in order to get a definitive answer. "Each individual may mean something descriptive by saying that the community is happier, but no one individual can observe the whole community, and each will inevitably take different facts into account."[13] Thus, we are back to the value judgement as the core on which policy must rest in the area of social welfare. No two men can be expected to have the same exact views of what is best. Each may have different sets of information available, different peer groups to be concerned about, and different time horizons. "One, looking a certain distance ahead, may favour a change which in his view will make every member of society better off ; another looking still further ahead,. may regard the same change with disfavour,.... The 'groups' whose welfare the two men are estimating are estimating are not the same. There is no reason why their estimates should coincide"[14] So private and public adjustment mechanisms grind and slide along, increasing or impeding the community's welfare according to different observers' viewpoints. The policy maker should be particularly concerned with the flows of information used in reaching adjustment agreements. Technical information, expert opinion and views of all concerned parties may, perhaps, be improved by having better channels of communications.

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[12] E. J. Mishan, Welfare Economics, 2nd edition, Random House, New York, 1969, p. 14.

Decision making based on what appears possible leads to "...what Professor Samuelson calls the feasibility locus. The feasibility locus tells us how well off it is politically feasible to make any one man, given the levels of well-being enjoyed by the others."." We move along it [the feasibility locus] by whatever means are for the moment regarded as feasible, changing the institutional set-up as we go."[15] Thus, society moves the existing efficiency locus closer to the welfare frontier by movements along the current feasibility locus. Proper government programs in training, counseling, information, education and in curbing monopoly power increase the potential that technological change may result in improving the actual efficiency and feasibility locus position relative to the welfare frontier.

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[13] Little, Welfare Economics, p. 75.

[14] J. de V. Graff, Theoretical Welfare Econ. p. 96.

In contemplating or advocating compensation and redistribution programs and other moves along the feasibility focus, it must be remembered that the actual form of the social organization involved may be an input into the community's welfare function; that is, the institutions which are used to generate end results for the system may be ends in themselves. "The market-mechanism itself provides a good example. A man may feel that its decisions are in some sense impersonal and unbiased, and he may prefer to have prices determined and income distributed by it rather than by some bureaucrat, at whose hands he may feel victimization..."[16] So movements to improve welfare along what is viewed as the feasibility locus will have to take into consideration any gains or losses in welfare generated by changes in the social institutions and the mechanisms set up to handle compensations. "The question what distribution of income would maximize happiness is partly independent of the question how income ought to be distributed."[17]

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[15] J. de V. Graaff, Theoretical Welfare Econ., p. 79

[16] Ibid. p. 120.

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Welfare Decisions and Uncertainty

The final topic for this chapter is the possible effects that imperfect knowledge and uncertainty may have on the worker's view toward technological change and on his preference among adjustment mechanisms. No individual nor any group has access to perfect knowledge concerning the final outcome of technological change on welfare. Even if individuals can agree on what are the proper goals for society, they may disagree on the usefulness of different mechanisms to reach these goals, on the likelihood of certain events occurring, and on the impact of these events on different individuals. "...They may disagree on the probable consequences of the event, or on the order of likelihood of those consequences--either because their own estimates of the situation differ or because they evaluate differently the reliability of the estimate of others."[18]

Differences may result from different individuals' preferences to handle or allow for uncertain outcomes. Some may react in a risk-taker approach expecting or hoping to gain; others may be extreme risk-averters, fearing calamity from any change in work tasks and opportunities brought on by technological change. Others may prefer a wait and see attitude retaining as much flexibility as is possible in order to adjust when better knowledge does become available. "Even if they agree on the probable consequences and their ordering, they may disagree on the 'proper' way to allow for the uncertainty involved--on whether to prepare for the worst or gamble on the best."[19]

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[17] I.M.D. Little, Welfare Econ., p. 66.

[18] J. de V. Graff, Theoretical Welfare Econ. p. 119.

Private and public adjustment mechanisms which include better information flows and more research concerning probable future events resulting from technological change may help bring about more agreement on what are proper adjustment mechanisms. "...most people would want to know what effects a certain change would have on someone's happiness before they would be prepared to say whether that change would be good or not."[20] No system can provide perfect knowledge about the future, so uncertainty must be allowed for in any policy or planning system. "Anticipations and the confidence with which they are held...enter quite directly into the determination of welfare. Our hopes and fears for the future should enter our utility functions quite explicitly--for they certainly affect our choices."[21]

The establishment of mechanisms (e.g., income maintenance, wider seniority, relocation and retraining programs) which would guarantee compensation from unforeseen future events might help reduce fears arising from uncertainty and aid in reducing the implementation of adjustment mechanisms which hinder change and growth. As pointed out before, the changing of social institutions required in order to establish these compensation guarantees may in itself cause a decline in welfare for some or many individuals, including those who would be eligible for the compensation.

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[19] J. de V. Graaff, Theoretical Welfare Econ., p. 119

[20] Little, Welfare Econ., p. 82

[21] J. de V. Graaff, Theoretical Welfare Econ., p. 120

Conclusion

To conclude we may summarize the topics covered in relating technological change and adjustment mechanisms to the promotion of social welfare. The inclusion of the external economic effects into the analysis means that when discussing the maximizing of economic welfare, more than just private, individual decisions concerning economic ventures (including technological changes and adjustment to change) must be considered. "The objective of the commercial profitability analysis is to maximize the nominal profitability of investment, while that of the social benefit cost analysis is to maximize national economic profitability as represented by the appropriately weighted sum of the net benefits accruing to different national objectives embodied in the national plan."[22]

The analytical framework must be expanded to a point which allows social welfare to entail much more than simply economic factors. The ceterus paribus assumption used in analysing economic changes is an inadequate base on which to build policy. "It is important to remember that we can never conclude that something ought to be done, from the proposition that economic welfare has increased. The means of increasing economic welfare may decrease welfare in general."[23]

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[22] A. K. Sen, "The Role of Policy Makers...", p. 25.

A lengthy discussion was devoted to reasons for not assuming that society will always be able to use Pareto-optimizing paths to equilibrium on the social welfare function. Private and public policies established to aid in maintaining and enhancing welfare, while technology varies, encounter numerous problems such as the following: "measurement" and comparison of net welfare changes based on value judgements; handling of interpersonal utility comparisons; allowing for utility directly from work and from social institutions; dealing with uncertainty; attempting to predict the effects of various adjustment mechanisms on the rate and direction of growth of the production possibilities surface over time, and hence, also on future occupation needs and satisfactions from work.

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[23] Little, Welfare Econ., p. 82.

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VOLUME I

PART II

STATE-OF-THE-ARTS STUDY

ABSTRACT

OF

MECHANISMS FOR AIDING WORKER ADJUSTMENT TO TECHNOLOGICAL CHANGE

This report attempts to establish the current knowledge or "state of the arts" concerning what mechanisms are available to aid worker's adjustment to technological change and the level of use of each of these mechanisms. A basis is provided for further research into the area of technological change and employment, and resulting changes in worker well-being. Part I of the study gives attention to the conceptual issues involved in the relationship between technological change and employment. Part II presents the current "state of the arts" in the literature. This includes the impact of technological change on workers, the adjustment mechanisms used by workers, and the policy recommendations contained in the literature.

Chapter One of Part I discusses how technological change might affect employment by altering the production function; by changing the cost-minimizing infant combinations; by altering the labor skill mix; by varying the demand for various goods and services; and by changing the input prices. Chapter Two reviews the issues involved in the various adjustment mechanisms used by workers in minimizing the impact of technological change. This includes the

adjustment mechanisms developed in the private sector and those developed in the public sector of the economy. Chapter Three of Part I contains a brief analysis of how the quality of the labor force may affect the rate of technological change and how the technological change may affect workers' attitudes. Chapter Four places the adjustment mechanisms within a theoretical welfare economics framework. Knowledge of these conceptual relationships and issues is essential in order to identify gaps in the existing knowledge and to recommend effective policies.

The review of the literature, which is the basis of the "state of the arts" study in Part II of the report, emphasizes material published since 1965. Other studies have adequately reviewed the literature published earlier. The literature includes empirical studies, "think-pieces," speculative articles and articles written to support the views of special interest groups.

Chapter One of Part II presents a summary of the findings on worker displacement because of technological change and adjustment mechanisms; analyzes the policy recommendations in the literature; and points out needed research to close the gaps in the existing knowledge. Chapter Two presents the detailed "state of the arts" study on the impact of technological change on workers and jobs in the aggregate economy; in the skill mix; by age, ethnic and sex groups; and by occupations and industry. Chapter Three contains the detailed review of the privately developed adjustment mechanisms and publicly developed adjustment mechanisms used to aid workers, and reviews which workers benefit the most and which workers benefit the least from these adjustment mechanisms.

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Risking overstatements, several generalizations from the existing literature are developed. By far the most common view in the literature (but not unanimous) is that technological change has affected job opportunities and altered needed skills somewhat, but that full employment with good job-information programs and privately developed adjustment mechanisms can handle and has handled the worker adjustment problems quite well in the vast majority of the cases. This is viewed as especially likely to be true if advanced notification of change and labor-management cooperation and planning are used. Some worker groups, such as older workers, minorities, females and, perhaps, younger workers and unskilled workers especially in non-union areas, may encounter more severe problems from technological change and need additional help in adjusting to the change.

The private sector has developed a large number of adjustment mechanisms for workers affected by technological change; and these private sector programs have, evidently, aided a great many workers in adjusting to change. Much of the impact appears to be handled by the non-glamorous adjustment mechanisms of on-the-job retraining and upgrading, and/or in-plant transfers, with more formalized retraining by companies and unions, attrition, wider seniority and some relocation. For those who become unemployed, the use of severance pay, counseling and placement aids appears fairly common, while supplementary unemployment benefits and, especially, guaranteed annual wages and work-sharing are used relatively little as adjustment mechanisms. Considerable use of pay incentives and, to a much lesser extent, profit sharing appears in the literature as means to compensate workers for accepting technological change. Moreover, many, perhaps a large majority of workers seem willing to accept new technologies because they believe this will lead to higher earnings. Little use of third-party representatives or other aids to labor-management negotiations was found in the literature.

Full employment policy is the most beneficial public policy, and it is basic to allowing the effective use of private adjustment mechanisms. Public retraining and, especially, public employment and public relocation assistance have been used sparingly as aids for technologically displaced workers.

Much of the literature reviewed either explicitly presents policy recommendations for aiding worker adjustment to technological change or strongly implies policy directions. The policy recommendations can, in general, be grouped into three general views. Those who see the impact of automation and mechanization as having drastic effects on skills and jobs naturally tend to propose policies which call for major changes in the system. Those writers who see little impact on skills and jobs obviously call for little additional policy beyond full-employment policy and basic labor-management cooperation. Finally, those writers and reports which were grouped into the "middle view" in this report call for extension of present activities and some development of slightly broader-based adjustment mechanisms but not for major revisions of the system.

The middle view represents the vast majority of those writers recommending policy. Most of these writers, who advocate continued use of collective bargaining and labor-management cooperative planning, spell out specific private adjustment mechanisms they feel will be beneficial. The use of various training, transfer, seniority and attrition programs in the private sector receives considerable attention. Thus most writers are calling for the continued and expanded use of the type of programs which appear to have been used the most as adjustment mechanisms in the past.

When employment must be reduced due to automation, one recommendation is to use normal attrition and early retirement programs to reduce the work force. Private counseling, placement and referral programs are recommended for displaced workers. These programs are also recommended in order to reduce anxiety in workers undergoing retraining and job transfers.

Several writers have pointed out that management can greatly reduce the impact of technological change if the rate of introduction and diffusion of the new technology is gradual rather than sudden. Wage incentives are recommended as a method of compensating workers in order to achieve better acceptance of technological change and to get workers to accept education and training which will create greater flexibility for change.

The public policies advocated include the needs for full employment and for cooperative labor-management planning. There is some dispute as to how to promote full employment programs. A large amount of literature advocates the expanded use of public retraining and relocation assistance programs and the expanded use of public education to aid workers adjustment to technological change. This is probably the greatest divergence found in the literature between mechanisms actually in use and those recommended. In the area of general education the picture is still somewhat clouded. A great many authors call for more education in order to allow greater worker flexibility to change, but there is no consensus concerning the type of education this requires.

As pointed out earlier, the basic private and public adjustment mechanisms discussed above are thought to be all that is needed to aid most workers in adjusting to technological change; however, special additional aids are recommended for special groups of workers in our economy. This extra help is usually assumed to be public programs in the areas of retraining, relocation, public employment, basic education, income maintenance and urban-regional development. Most authors see little use and need for work rules of the restrictive or guaranteed-numbers-of-jobs nature.

To summarize, most of the literature concludes that policies of full employment and labor-management cooperation, including advance planning for change will handle the vast majority or worker adjustment problems. Private adjustment mechanisms should include a multiple number of adjustment options to give workers alternatives to best fit their own needs and preferences. Public adjustment mechanisms include a recommended expansion of retraining and education for adaption to technological change; however, just what type of training and education--broad, narrow, etc.--that will best aid worker adjustment is not clear. Public adjustment programs also need to be expanded to aid particular groups in the work force including minorities, women, older workers and the unskilled.

A single comment concerning the general "state of the arts" in this area would have to stress the almost complete lack of any solid research that examines a representative sample of the labor force. The existing literature is limited, almost entirely, to relatively narrow inquiries which therefore have only limited general implications.

CHAPTER I

SUMMARY, POLICY IMPLICATIONS, AND RESEARCH NEEDS

Introduction

Part II presents a review of the literature which outlines and critizes the published knowledge and opinions concerning the private and public adjustment mechanisms used by workers in adapting to technological change. Time and financial constraints limited the study to the literature published from 1965 through 1973. Other reviews have summarized the earlier literature. Chapter I summarizes the findings, reviews the various policy recommendations that are contained in the existing literature, and points out gaps in the existing knowledge which need to be closed or narrowed in order to make more enlightened policy recommendations in this area possible. Chapter II discusses which workers have been affected adversely and which favorably by technological change. Chapter III discusses the various adjustment mechanisms that have been used and what workers appear to have benefited the most from these mechanisms. In these chapters the "existing knowledge" is criticized on the basis of its theoretical content, speculative discussions and the empirical evidence it presents.

The "findings" presented here are drawn from many diverse articles of varying quality, including good and mediocre empirical research, "think-pieces," futuristic speculations, and the perspectives of special interest groups. A noteworthy comment on the general state-of-the-arts in this area is the almost complete lack of any solid research that examines a representative sample of the labor force. The existing literature is limited, almost entirely, to relatively narrow inquiries which therefore have only limited general implications.

Summary of Worker Displacement and Adjustment

The extent that technological change has affected skill requirements and jobs and thus threatens to displace workers may be divided into three general views. The most radical view is that technological change has had a great impact on the skill-mix requirements and on jobs in the economy. The view of adjustment mechanisms as expressed by the majority of this group is that they have been inadequate. Private adjustment mechanisms are largely lacking in the non-union sector; and good adjustment mechanisms are lacking in the unionized sector, because the rate and impact of technological change has destroyed union powers to resist and/or to aid workers. Some authors who concluded that technological change had been rapid and very significant in its impact on jobs found many private adjustment mechanisms to be working well and greatly aiding worker transition to change.

The opposite view is expressed by writers who conclude that technological change has had relatively little impact on skill requirements and thus on jobs. These authors naturally believe little attention needs to be given to adjustment mechanisms except in a few isolated cases. Full-employment policies by the government and basic minimal on-the-job retraining and, perhaps, transfers to new jobs with similar or identical skill requirements are all that are required, according to this view. Some of the advocates of this "little impact" view conclude that employers may create more employment problems than need be with technological change by unnecessarily increasing skill requirements for entry into jobs.

The third and by far the most common view or position is that technological change has affected job opportunities and altered needed skills somewhat, but that full employment with good job-information programs and privately developed adjustment mechanisms can handle and have handled the worker adjustment problems quite well in the vast majority of the cases. This is viewed as especially likely to be true if advanced notification of change and labor-management cooperation and planning are used. For special groups who encounter more severe problems from technological change, such as older workers, minorities, females and, perhaps, younger workers and unskilled workers especially in non-union areas, additional help may be needed. This extra help is usually assumed to be public programs in the areas of retraining, relocation, public employment, basic education, income maintenance and urban-regional development. Most authors of this "middle view" see little use and need for work rules of the restrictive or guaranteed-numbers-of-jobs nature. In fact, the use of these provisions may have decreased over the last two decades. Even where job security provisions have been used, very little retarding of the rate of technological change has occurred, according to the evidence put forth by these writers.

The review of the literature on the actual adjustment mechanisms used tends to support the "middle view" concept of technology and worker displacement. The full employment policy is the most beneficial public policy, and it is basic to allowing the effective use of private adjustment mechanisms. Public retraining and, especially, public employment and public relocation assistance have been used sparingly as aids for technologically displaced workers.

In the private sector, much of the impact appears to be handled by the non-glamorous adjustment mechanisms of on-the-job retraining and up-grading, and/or in-plant transfers, with more formalized retraining by companies and unions, attrition, wider seniority and some relocation. For those who become unemployed, the use of severance pay, counseling and placement aids appears fairly common, while supplementary unemployment benefits and, especially, guarnateed annual wages and work-sharing are used relatively little as adjustment mechanisms. Considerable use of pay incentives and, to a much lesser extent, profit sharing appears in the literature as means to compensate workers for accepting technological change. Moreover many, perhaps a large majority of workers seem willing to accept new technologies because they believe this will lead to higher earnings. Little use of third party representatives or other aids to labor-management negotiations was found in the literature.

It does appear that unionized workers have more alternative adjustment mechanisms available to them than do non-union workers; however, it should be remembered that some writers felt unions were not particularly effective in establishing adjustment mechanisms. The reasons given for this were either that there was a lack of concern by union leaders, or, more often, that there was less union power due to the reduced workforces and reduced union membership brought on by technological change.

Another fairly common consensus is that the growth of adjustment mechanisms and the sometimes difficult labor-management negotiations resulting from the introduction of new technologies have not retarded the adoption of technological improvements in most areas of the United States' economy. The use of restrictive work rules and narrow job protection provisions is light in most sectors of the economy and tends to be concentrated mainly among the skilled-crafts groups. Many writers have pointed out that the continued introduction of new technologies in industries and occupations such as railroads, longshoremen, steel and princing has generated a great deal of discussion concerning restrictive work practices. Often these restrictive practices have been greatly modified in return for the introduction of other adjustment programs. The only area of the economy which receives much attention concerning the possibility of detrimental effects resulting from restrictive work rules (i.e., lower productivity and higher cost) is the construction industry.

Policy Recommendations in the Recent Literature

Much of the literature reviewed in Chapters II and III of this part of the report either explicitly present policy recommendations for aiding worker adjustment to technological change or strongly imply policy directions. In this section the policy recommendations from the various writers are consolidated and present. The literature cited in this section will be limited to the material published over the last six years (1968 through 1973), since the various policy ideas published before then have been presented in earlier reviews.[1]

The policy recommendations can, in general, be grouped into the three general views (as developed in the preceding section of this chapter). Those who see the impact of automation and mechanization as having drastic effects on skills and jobs naturally tend to propose policies which call for major changes in the system. Those writers who see little impact on skills and jobs obviously call for little additional policy beyond full-employment policy and basis labor-management cooperation. Finally, those writers and reports which were grouped into the "middle view" in this report call for an extension of present activities and some development of slightly broader-based adjustment mechanisms but not for major revisions of the system.

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[1] Prasow and Massarik (69:26.00)
Weber (68:10.00)
National Commission (66:41.00)
NICB (66:42.00)
Calif. Commission (64:6.00)

(Footnote number references correspond to Bibliography entries, with the first two digits representing the year of publication and the balance the alphabetical order for the year.)

A considerable amount of the policy-related literature over the last six years has been concerned with workers' attitudes toward technological change and with developing programs for job enrichment in order to increase worker satisfaction.[2] These programs must be viewed as part of the total policy "package" along with the financial and job-security programs discussed earlier since the broad goal of all adjustment mechanisms, (as discussed in the conceptual chapter in Part I on welfare theory and worker adjustment) is to increase satisfaction for the worker on the job and for the worker and his family consumers.

Among those writers who see a need for major shifts in policy due to technological change are those who advocate nationalization of industry[3] (i.e., socialism) as the proper government response. Kelso and Hetter,[4] however, believe that the system could be improved by making everyone a capitalist, an owner of corporate stock. Ferkiss[5] sees society as being drastically changed by the impact of technology; and he sees this change destroying the ability of the old style "bourgeois man" or industrial man to provide leadership. Society's salvation lies in the creation of "technological man" who will be able to control and coordinate technological change and thus to preserve society.

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[2] For example, see:

Champagne (72:3.00)
Knecht (72:13.00)
Sheppard (72:18.00)
Winpisinger (72:22.00)
Cancro (71:2.50)
Davis (71:2.40)
Davis (71:2.50)
Sheppard (71:8.50)
McNiff (70:9.50)
Presthus (70:13.00)
Smith (70:17.50)
Sheppard (69:30.00)

[3] Bloice (72:1.75), Melachanik (69:22.00)

[4] Kelso and Hetter (72:11.50)

Several other authors conclude that technological change is having major impacts on society; however, their recommended solutions do not entail as radical a set of changes as do those expressed in the preceding paragraph. Most of these writers feel that past government policy has been inadequate and based on short-sighted planning; thus the need is for greater planning and broader public policies.[6] Some such as Seligman[7] recommend the adoption of government representation in collective bargaining in order to ensure that adequate attention is being given to the consequences of automation.

An often expressed need is for enlarged public employment programs in order to maintain job opportunities and to provide needed services to society.[8] Those authors who see technological change creating much new leisure time have emphasized the need for new education programs to teach people how to deal with this leisure time.[9] Others see education and training changing to give workers the ability to adapt to a continual shift from one occupation to another over their working life because of technological change.[10] The unionists' view that American business uses new technology along with cheap labor in foreign nations to destroy American workers' jobs leads to their advocating more restrictive import quotas as a job protection measure.[11]

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[5] Ferkiss (69:6.50)

[6] Kassalow (70:8:00), Barnes (70:0.50)

[7] Seligman (70:13.90)

[8] Siemiller (70:7.20) Siegel and Belitsky (70:17.00)
Sexton and Sexton (71:8.25)

Private sector adjustments advocated by these writers who see technological change as having major impacts on the system include work sharing via longer vacations and shorter working hours,[12] flexible work scheduling,[13] more adapting technological change to meet workers' skills and behavior rather than forcing workers to adapt with little choice.[14] The writers also recommend that workers be represented on the board of directors of the enterprises.[15]

Articles representing the opposite view, that technological change has had very little impact on the system and therefore little or no policy is needed besides full employment and basic labor-management cooperation, are fairly sparse. Jaffe and Froomkin[16] and Weinburg[17] conclude that little unemployment is caused by technological change and what is caused can be taken care of by the government actions to stimulate aggregate demand. An article in the Monthly Labor Review[18] emphasizes the necessity of promoting home construction and reducing restrictive work-practices in the industry, but views legislation and/or governmental intervention as too harsh measures to use. In relation to worker satisfaction, an article by W. H. Form[19] is representative of several articles which conclude that considerable evidence exists which points to the major modification or even abandonment of the technological explanations of worker alienation.

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[9] Reisman (71:7.00)

[10] Lee and Lancaster (71:4.60)

[11] Shepard (71:8.00)

[12] Seimiller (70:17.20)

[13] Best (73:0.50)

[14] Meissner (69:21.00)

[15] Delacourt-Smith (70:3.55)

The two more extreme views or positions concerning policy for aiding worker adjustment to technological change have been covered. and a turn to the middle view is made which represents the vast majority of those writers recommending policy. A number of writers have recommended the continued, expanded use of labor-management cooperation and bargaining as vital to the establishment of effective adjustment mechanisms.[20] Other articles have advocated the continued use of collective bargaining and cooperation for specific industries and occupations including longshoremen,[21] railroads,[22] printing[23] and airlines.[24] Several authors call for more planning for adjustment by management[25] and by personnel administrators,[26] while others point out the need to plan with the cooperation of labor and to allow the workers (or unions) to share in the decision process.[27] The need for advance notification of change is often discussed[28] in order to gain cooperation from labor, to allow for labor cooperation in planning and to give workers sufficient lead time in which to find alternative work to other options.

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[16] Jaffe and Froomkin (68:6.00)

[17] Weinburg (70:17.85) and Weinburg does advocate more use of education and wider use of several private adjustment mechanisms.

[18] DOL (69:35.00)

[19] Form (72:6.00)

[20] Rosow (72:16.00) Perline and Tull (69:25.00)
Meshel (70:11.70) Weber (68:20.00)

Most of the writers who advocate continued use of collective bargaining and labor-management cooperative planning also spell out specific private adjustment mechanisms they feel will be beneficial. The use of various training, transfer, seniority and attrition programs in the private sector receives considerable attention. Thus most writers are calling for the continued and expanded use of the type of programs which appear to have been used the most as adjustment mechanisms in the past.

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[21] Goldberg (68:5.00)

[22] Rehmus (71:6.50), Levine (69:14.00)

[23] Critchlow (70:3.00)

[24] Kahn (71:4.25)

[25] O'Carroll (71:6.25)
Rothberg (69:29.00)
Stern (69:3.100)

[26] Rezler (72:15.00)

[27] Davey (72:4.00)
Knecht (72:13.00)
Burack and Pati (70:2.00)
Prasow and Massarik (69:26.00)
OECD (68:0.75)
Freedman (68:4.50)

[28] BLS, DOL (72:2.00)
Weinberg (70:17.85)
Levine (69:14.00)
Prasow and Massarik (69:26.00)
Rothberg (69:29.00)
Stern (69:31.00)
Ullman (69; 33.00)
Freedman (68:4.50)

The use of company and union training and retraining programs is probably the most often recommended specific adjustment aid for the private sector.[29] On-the-job training is cited[30] as the optimal method to develop skills for specific new work activities generated by technological change, but it is probably too narrow to "educate" workers for adaptation to change. In fact, a U.S. Dept. of Labor study[31] concludes that in-plant education in general often teaches a person only skills directly related to his particular job and not skills related to increasing that worker's mobility. This is to be expected for profit-maximizing firms, since the firm can expect to recapture the investment costs of the specific training; but the investment costs of more generalized training which increases worker mobility may be lost if this allows the worker to change employers.

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[29] For example, see:
BLS,DOL (72:2.00)
Howenstine (72:8.00)
Vickery (72:21.00)
Mortimer (71:4.90)
O'Carroll (71:6.25)
Burack and Pati (70:2.00)
Critchlow (70:3.00)
Weinberg (70:17.85)
Levine (69:14.00)
Prasow and Massarik (69:27.00)
Rothberg (69:29.00)
Stern (69:31.00)
Ullman (69:33.00)
Burack and McNichols

[30] Burack and Pati (70:2.00)
Mueller, *et al.* (69:23.00)
Prasow and Massarik (69:27.00)

[31] DOL (68:9.00)

Rezler[32] advocates the use of continued retraining and educational upgrading for personnel managers in order to allow them to plan better for the needed retraining and transfer of workers affected by technological change.

Much of the retraining may be combined with intraplant or interplant transfer and relocation.[33] Of course, transfers to identical jobs may also be used as adjustment mechanisms if this is feasible. The use of relocation is viewed as highly desirable in the case of plant shutdowns.

When employment must be reduced due to automation, one recommendation is to use normal attrition[34] and early retirement programs[35] to reduce the work force. Private counseling, placement and referral programs are recommended[36] for displaced workers. These programs are also recommended in order to reduce anxiety in workers undergoing retraining and job transfers.

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[32] Rezler (72:15.00)

[33] BLS, DOL (72:2.00)
Rezler (72:15.00)
Wolfbein (70:19.00)
Stern (69:31.00)
Ullman (69:33.00)

[34] Critchlow (70:3.00)
Weinberg (70:17.85)
Rothberg (69:29.00)

[35] Levine (69:14.00), Ullman (69:33.00)

[36] Rothberg (69:29.00)
Stern (69:31.00)
Ullman(69:33.00)

Other authors[37] have recommended job security provisions as adjustment mechanisms. Several writers have pointed out that management can greatly reduce the impact of technological change if the rate of introduction and diffusion of the new technology is gradual rather than sudden.[38] Wage incentives are recommended as a method of compensating workers in order to achieve better acceptance of technological change[39] and to get workers to accept education and training which will create greater flexibility for change.[40]

The discussion has been elaborating on specific private adjustment mechanisms recommended by writers in what we called the "middle view" concerning technological change and employment. We now turn to the public policies advocated by this group. Of course, full employment policy is taken as a basic requirement to all other adjustment mechanisms.[41] A large amount of literature advocates the expanded use of public retraining[42] and relocation assistance programs[43] and the expanded use of public education to aid worker adjustment to technological change. This is probably the greatest divergence found in the literature between mechanisms actually in use and those recommended. Several writers cite the special need for public retraining programs for technologically displaced workers in the non-unionized sector.[44]

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[37] Weinberg (70:17.85), Levine (69:14.00)

[38] Critchlow (70:3.00)
Herman (70:6.00)
Prasow and Massarik (69:27.00)
Manpower Adm., DOL (68:9.00)

[39] Kahn (71:4.25), Mueller, _et al._ (69:23.00)

[40] Burack and McNichols (68:0.50)

[41] Howenstine (72:8.00)
Bell (71:1.00)
Wolfbein (70:19.00)
Stern (69:31.00)
Ullman (69:33.00)

[42] Bell (71:1.00)
Mortimer (71:4.90)
Larkin (70:9.30)
Weinberg (70:17.85)
Wolfbein (70:19.00)
Ullman (69:33.00)
OECD (68:0.75)

In a review of the literature through 1967, Prasow and Massarik[45] concluded that education must change significantly in order to aid people in adjustment; just what form the education should take--broader, comprehensive, specialized, or some combination--was not clear. The picture is still somewhat clouded. A great many authors[46] call for more education in order to allow greater worker flexibility to change, but there is no consensus concerning the type of education this requires.

In addition to education for change, other writers have called for basic adult education[47] and vocational education[48] for unskilled farm workers The Mueller, *et.al.* study[49] concluded that specific on-the-job-training seemed to prepare workers for new jobs better than vocational education does. Other studies[50] have advocated public education which teaches the latest applications of new technology in order to keep management abreast of current developments.

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[43] Wolfbein (70:19.00)
Canada, Dept. of Labour (69:2.00)
Rothberg (69:2.50)

[44] Cargill and Rosemiller (69:2.50)
Fulco (69:8.00)
Zeisel (68:21.00)

[45] Prasow and Massarik (69:26.00)

[46] Drucker (73:0.75)
Lee and Lancaster (71:4.60)
Mueller, et. al. (69:23.00)
Ullman (69:33.00)
Bell (71:1.00)
Manpower Adm., DOL (68:9.00)

[47] Cargill and Rosemiller (69:2.50)

[48] Fulco (69:23.00)

In order to speed up the adjustment process and reduce the cost of worker adjustment to technological change for the individuals involved and for society, several studies[51] have called for the expanded use of public planning. The planning can encompass education, retraining and relocation problems as well as provide information[52] concerning the impact of technological change and means of adjusting to the change. Planning and information programs can also lead to the effective utilization of public counseling and placement programs[53] to aid the re-employment effort of displaced workers. Stern[54] concludes that information, placement, and counseling programs combined with a full employment economy are effective methods for handling the adjustment of most displaced workers.

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[50] Burack and Pati (70:2.00), Burack and McNichols (68:0.50)

[51] Bell (71:1.00)
Burack and Pati (70:2.00)
Stern (69:31.00)

[52] Larkin (70:9.30)
Stern (69:2.50)
Manpower Adm., DOL (68:10.00)

[53] Larkin (70:9.30)
Cargill and Rosemiller (69:2.50)
Zeisel (68:21.00)

[54] Stern (69:31.00)

As pointed out earlier, the basic private and public adjustment mechanisms discussed above are thought to be all that is needed to aid most workers in adjusting to technological change; however, special additional aids are recommended for special groups of workers in our economy. One such special group is the unskilled, non-unionized workers. Studies of the farm workers and textile mill workers can demonstrate the policies recommended for these workers who are being displaced by new technologies.

Basically the recommendations are for expanded public programs and services. Schmitz and Seckler[55] point out the need for policies to distribute the benefits and costs of technological change more equitably. A study edited by Cargill and Rosemiller[56] recommends enlarged public programs for farm workers, including adult basic education, retraining, public employment, extended unemployment benefits, and rural job development. Fulco[57] also argues for public retraining of the MDTA type for farm workers but believes that farm mechanization will lead to larger farms where unionization will be easier to establish. For textile mill workers, Zeisel[58] urges expanded public programs of retraining, unemployment benefits and placement. She argues that this will be especially beneficial to Blacks who will be relatively the hardest hit by technological displacement in the industry.

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[55] Schmitz and Seckler (70:13.40)

[56] Cargill and Rosemiller (69:2.50)

[57] Fulco (69:8.00)

[58] Zeisel (68:21.00)

Young[59] believes Black workers will suffer relatively more technological displacement in the economy as a whole and argues for guaranteed annual incomes and public employment to aid these dispossessed. Agassi[60] believes women are also likely to suffer relatively greater displacement due to technological change. She stresses the need for laws giving women equality of opportunity in private programs such as seniority, pension rights, job security, promotion and training in order to allow women workers to benefit equally with men from technological change. She also recommends a large increase in public child care centers and other social services to aid the working woman.

Several authors have recommended policies specific for older workers affected by automation. These include provision for early retirement,[61] with special attention being given by the federal government to ensure a livable retirement income and adequate housing and recreational facilities.[62] Dalton and Thompson[63] believe older workers can be aided in maintaining employment by private programs for refresher education and training, by better coordination of job assignments and skills available by counseling, and by vesting of pension rights to enable older workers to change jobs more easily.

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[59] Young (70:20.00)

[60] Agassi (72:1.50)

[61] Levine (69:14.00) Goldberg (68:5.00)
Mueller, et al. (69:23.00)

[62] International Colloquium (70:0.10)

[63] Dalton and Thompson (71:2.00)

To summarize this section, most of the literature concludes that policies of full employment and labor-management cooperation, including advance planning for change, will handle the vast majority of worker adjustment problems, although some improvement is needed in the non-union sector. Private adjustment mechanisms should include a multiple number of adjustment options to give workers alternatives to best fit their own needs and preferences. Public adjustment mechanisms include a recommended expansion of retraining and education for adaption to technological change; however, just what type of training and education--broad, narrow, etc.--that will best aid worker adjustment is not clear. Public adjustment programs also need to be expanded to aid particular groups in the work force including minorities, women, older workers and the unskilled.

Gaps in the Existing Knowledge in the Literature

The discussion of the gaps in the literature will be confined to issues at the aggregate level rather than at the level of particular industries or occuaptions. Few of the underlying theoretical relationships discussed in Part I among technological change, production processes, cost, output and employment levels are incorporated in the existing studies; likewise, only a few of the discussions concerning adjustment mechanisms are based on a welfare framework in which the pros and cons of differing approaches are weighed and compared. As pointed out above, the most common assumption is that an economy which maintains a full-employment growth path will minimize the need for elaborate adjustment mechanisms by minimizing the impact of technological change on job opportunities. Few studies attempt to analyse the effect that different types of adjustment mechanisms have on the potential, non-inflationary growth rate of the economy.

There is a serious gap in the knowledge concerning the actual effect technological change is having on employment. This is witnessed by the many diverse opinions found in the literature. There has been little empirical evidence developed concerning shifts in the production function resulting from technological improvements; that is, are these shifts labor saving, labor using or neutral, and what is the quantitative effects on labor needs?

Perhaps more important, little appears to be known concerning the effect of technological changes on the skill-mix required by employers. Has it on the average, increased the skill levels required or decreased the requirements? Has it eliminated some skills while creating a need for new ones? How large has been the shift in the skill-mix? Many authors, but not all, conclude the shift tends to be small in most cases, allowing for easy worker flexibility in adapting to the slightly different work activity. In relation to this skill-mix shift, several authors argued that the skill requirements are lowered over the longer-run after a technological innovation, as employers attempt to break up and to routinize the job duties in order to lower labor costs. Little empirical evidence concerning this short run-long run skill-mix shift has been developed, however.

Even if technological changes reduce labor requirements in general or for specific skill groups for a given output level, the change may also reduce costs. If this leads to lower prices and greater sales, then the derived demand for labor will increase which will help to offset any reduction in labor demands caused by the initial technological change. As has been pointed out in an earlier study,[64] however, little is known about the relationship between cost changes and price changes and thus about the effect of technological change on the expansion of sales and employment opportunities in the plant.

Another area where little research appears in the current literature concerns shifts in the relative input price ratios of capital and labor as new technologies are introduced. This input price shift could occur as a result of the use of new capital equipment, as a result of shifts in the skill-mix needed by the new technology and/or from reactions to the change by unions which affect labor costs.

Still another apparently unresearched topic is the effect a technological change in the production of one commodity has on the sales of goods and services which are complements or substitutes to the original commodity. If the technological change creates increases or decreases in the sales of other commodities, then this would lead to increases or decreases, respectively, in employment in these industries. Unfortunately, virtually nothing appears in the literature concerning the size of these indirect effects.

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[64] Manpower Adm., DOL (68:10.00)

Several studies have researched the question of which worker groups, by levels, demographic characteristics, industry and degree of unionization, have made successful adjustments to change and which have not. The surveys tend to have been limited in sample size, to have been specific to particular industries or occupations, and/or to have used net statistics rather than using statistics pertaining to individuals involved. Thus several authors have called for further research in these areas using larger, more comprehensive sample sizes.[65] The Mueller,[66] et al. study group also called for more research covering labor-force dropouts as related to technological change and the welfare loss incurred by these ex-workers. They also advocated more research on the effects of technological change on workers during periods of slow or stagnant economic growth as compared to their study (and others' studies) based in the strong full employment period of the late 1960's.

Much of the literature on worker adjustment is related to what types of adjustment mechanisms are found in labor contracts and in other agreements. Considerable work has been done to determine which of these adjustments techniques are most used and preferred by various worker groups; but there still appears to be considerable room for more research into which mechanisms are viewed as most satisfactory before technological innovations occur and after the actual change takes place, in the short-run and in the long-run.[67] Related to this is the question of how much choice among various alternative mechanisms do individual workers have, and how good is the information on which they must base their decisions. In addition, more research is needed concerning the benefits and costs of the various adjustment mechanisms to individuals, firms and society as a whole.[68] This must be done before rational studies of cost and welfare effectiveness of the various proposals can be attempted.

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[65] Mueller, et al. (69:23.00), International Colloquium (70:0.10)

[66] Mueller, et al. (69:23.00)

In the public sectors, questions still need to be answered concerning what type and how much education and training is optimal for aiding workers' adjustment and maximizing societal welfare. The literature calls for expanded public programs of education and retraining; but it also promotes many, often contradictory approaches. As discussed earlier, several writers believe that full employment can be maintained only through the use of public employment programs; however, a greater number see no need for public employment as a long run or permanent feature. Finally a few studies called for more public representation in private labor-management negotiations. Unfortunately, national goals and priorities and even information needed to establish goals are either not available or not unanimously agreed upon in the current knowledge. Likewise, methods for controlling private sector agreements to make them fall more in line with national policies have not been greatly researched to date.

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[67] Manpower Adm., DOL (68:10.00)

[68] Lee and Lancaster (71:4.60), Manpower Adm., DOL (68:10.00)

CHAPTER 2

TECHNOLOGICAL IMPACT ON WORKERS AND JOBS

Introduction

Risking overgeneralization a summary of the findings of this chapter shows that in the aggregate economy, as long as full employment growth is maintained, technological change has not increased and is not increasing the percentage of the eligible work force who are unemployed. In specific regions, industries, occupations and worker groups, problems do appear to exist. No specific conclusions about these problem areas and about the value of specific adjustment mechanisms exist unanimously in the literature. The actual empirical research is spotty and usually localized in scope. Much of the "factual" research on industries is based on reported contractual agreements and arbitration decisions.

The occupational studies tend to use national aggregate statistics; using these obscures the effects in local labor markets and on individual workers. Many of the conclusions reached concerning the impact of technological change and the value of adjustment mechanisms are somewhat tentative. Contrasting results and recommendations can be found for most industries and worker groups studied.[1]

The remainder of this chapter is divided into five sections. Section one will present evidence dealing with the general view of technological change and jobs. Section two will contain material based on effects by skill level and blue-collar versus white-collar jobs. Section three will review the current state-of-the-arts for various ethnic groups, sexes and age groups. Section four will contain the various industry and occupation studies. Section five will present general material on technological change and job satisfaction, and on employment with changing technology in differing economic systems.

Technological Change and Aggregate Employment

At the aggregate level, the majority viewpoint is that technological change is not creating massive unemployment nor increasing the percentage of unemployed in the economy. This was the basic finding of the National Commission on Technology, Automation, and Economic Progress in 1965; and it has tended to be re-enforced over the last eight years. Weinberg in a 1970 article[2] states that technology has not been responsible in and of itself for increasing unemployment; the views expressed by Silberman,[3]

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[1] The same basic conclusions were reached in a study reviewing the literature from 1956-1967. See Prasow and Massarik, (69:26.00). The number in parentheses is the article index number by which the article is listed in the bibliography at the end of Part II of this report.

[2] Weinberg (70:17.85)

[3] Silberman (66:56.00)

Mueller,[4] and in a U.S. Dept. of Labor publication[5] agree with Weinberg's opinion. Weinburg feels that the pace of technological change has been quickening without affecting aggregate employment adversely; however, Silberman stresses that there simply has not been as much automation, in reality, as is often supposed. Silberman feels that social commentators have overplayed the growth of automation and its impact on acutal jobs. Felix Parkert, in an article concerning Western European employment and technological change, goes a step further and argues that in the aggregate unemployment has actually been decreased as a result of the introduction of new technology.[6]

One of few empirical studies dealing with technological impact on workers in all regions and occupations was conducted at the University of Michigan by Eva Mueller et al. The study surveyed 2,662 workers in 1967 to determine the effects of technological change. The results showed that very few workers had been unemployed or had worked shorter hours because of technological change, although 10 percent reported their jobs had been affected. The study did show that better-educated workers may have been influencing the rate of technological change (as discussed in Section one, Chapter III of Part I of this report). Mueller et al. also reported that most workers appeared to like working with improved machines because doing so improved their chances for increased earnings. The Mueller study was perhaps biased by not including labor force dropouts and by using a relatively small sample size.

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[4] Mueller, et al. (69:23.00)

[5] U.S. Dept. of Labor (68:10.00)

[6] Parkert, (68:13.00)

[7] Mueller, (69:23.00)

As stated in the introduction, contradictory views on just about every position or conclusion can be found in the literature. Exceptions to the view that there is little impact on aggregate employment from technological change are represented by Deutsch,[8] Seligman[9] and Page.[10] Deutsch found that 60 percent of the union leaders interviewed believed that automation increased unemployment. Those leaders who were somewhat confused about the concept of automation tended to show more apprehension about change. This study does not, of course, pick up the aggregate employment effects, but only the possible employment effects within the industries or firms represented by the interviewed union leaders.

Seligman and Page feel that technological change leads to serious employment problems in the economy. Page was particularly concerned that by the time the statistics revealed the employment effects, it might be too late to change the process. It should be noted that the articles expressing fear of technological change were generally written in the earlier half of the 1960's or the late 1950's. The fear of automation eliminating jobs thus appears to have lessened since the mid 1960's. This may be due partially to the long sustained full-employment growth the American economy experienced in the 1960's. Mueller et al. did recommend that more studies be made during periods of slow economic expansion.

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[8] Deutsh (68:2.00

[9] Seligman (66:52.00)

[10] Page (64:25.00)

Technological Change and the Skill Mix

Probably the most popular idea associated with technological change is that is has significantly lowered the demand for blue-collar, low-skilled workers. This view is expressed often in the literature (as represented by King,[11] Moore,[12] Michael[13] and Killingsworth[14]). King in his 1972 Ph.D. dissertation reviewed arbitration cases from 1960 to 1970; therefore his results would be for the unionized sector. He found that unskilled jobs were being eliminated; however, he also found that if the jobs were covered in current contract provisions, an attrition scheme was usually established by the arbitrators. These authors all saw unskilled positions as being eliminated in favor of more skilled activities.

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[11] King (72:12.00)

[12] Moore (70:12.00)

[13] Michael (67:13.00)

[14] Killingsworth (64:17.00)

Contrary to the aboveposition are arguments expressed by Perline and Tull[15] and by James Bright[16] who feel that automation may actually lower the average skill levels required in industry. Bright feels that the skill upgrading will be necessary only in the maintenance-worker area where more sophisticated machinery must be maintained.

A Bureau of Labor Statistics study[17] covering twelve plants in six basic industries reported little employment impact caused by the introduction of computerized production systems. Some jobs demanding higher skills were created, but little employment reduction occurred at any of the skill levels. Prasow and Massarik[18] interviewed workers in six aerospace firms and found little fear of job loss from automation; however, these were more skilled than average industrial workers, and in these firms effective on-the-job retraining was being used extensively. Prasow and Massarik also felt that technological improvements were creating jobs for higher-skilled workers and technicians. Rosenburg[19] and Kendrick[20] agree that technological change will, in general, raise skill requirements in all occupations throughout the economy.

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[15] Perline and Tull (69:25.00)

[16] Bright (66:8.00 & 66:9.00)

[17] B.L.S., U.S. Dept. of Labor (70:6.00)

[18] Prasow and Massarik (69:27.00)

[19] Rosenburg (66:51.00)

[20] Kendrick, (64:15.00)

Seligman,[21] like Bright, believes automation and mechanization will eliminate many skilled workers. El-Shanawaui[22] agrees with Seligman that many skilled jobs will be eliminated; however, he sees the decrease occurring in the traditional, more physical-skilled, blue-worker jobs, with an increase occurring in demand for new skilled jobs requiring more perceptual and conceptual abilities. Weinberg and Ball[23] feel that all skill levels will have to become more flexible and adaptable to change as technological change continues and, perhaps, quickens. This need for adaptability is stressed in a study of the housing construction industry in Europe by Howenstine.[24] He found that the shift to prefabricated housing was transferring many work activities from the constuction site to the factory and reducing the need for some traditional craft skills while creating a demand for a new occupation--assembling. The shift has also changed the type of occupational safety and health hazards faced by workers in home construction.

Many authors express the belief that in the general upgrading of skills, the number of blue-collar jobs in decreasing while the number of white-collar jobs is increasing. This belief is expressed in articles by

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[21] Seligman (66:52.00)

[22] El-Shanawaui (62:0.50)

[23] Weinberg and Ball (67:23.00)

[24] Howenstine (72:8.00)

Clark,[25] Kassalow,[26] and in an article in the Oil and Gas Journal.[27] The latter two articles stress that the move to relatively more white-collar jobs means a reduction in the percentage of employees represented by unions, and both believe the change will have adverse effects of unionism. Kasalow presents evidence for his case from government reports and statistics, from case studies and from other articles.

In the late 1950's and early 1960's many studies expressed the belief that the trend of blue-collar to white-collar jobs was having adverse effects on unions and unionization in the United States. Representative of this position are articles from that time period by the following authors: Rezler,[28] Weber,[29] Barbash[30] and Stern.[31] These authors held that the union movement had to enter the white collar occupations in order to remain viable, and this would be extremely difficult.

The chapter on adjustment mechanisms will deal with the use of collective bargaining as a device to establish adjustment mechanisms, but, a quick note at this point appear appropriate. One view, as expressed by Barbash and Stern, is that unions will be weakened by technological change which eliminates blue collar jobs. Unions will thus be less able to defend workers affected by change and will have to take mainly a defensive stance. The opposite view is expressed by writers (such as Kirsh[32]) who feel that unions and collective bargaining have dealt successfully and will deal successfully with technological change and will be able satisfactorily to aid worker adjustment.

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[25] Clark (66:16.00)

[26] Kassalow (70:8.00)

[27] Oil and Gas Journal (69:9.50)

[28] Rezler (66:50.00)

[29] Weber (66:63.00)

[30] Barbash (63:1.00)

[31] Stern (63:15.50)

In the late 1960's and early 1970's, the literature is almost devoid of any concern that technological change might adversely affect unionization. Perhaps this is because there was growing evidence to the contrary. Perhaps it is because the full employment growth which occurred over the 1960's (as compared to the growth over the period 1958 to 1963) simply created so many jobs, blue collar and white collar, that less threat was felt by unions. Concern may have lessened because of the growing trend toward unionization in white collar, service and public-sector occupations.[33]

While many studies point to the growth in white collar, non-production jobs, according to several articles, these jobs are also undergoing considerable change as a result of technological change. Burack and Pati[34] and Rezler[35] see many management functions becoming obsolete as automation occurs and new functions become necessary. Drucker[36] sees the emerging white collar worker as a "knowledge worker", a person who produces and distributes information and ideas. Carter[37] believes the decline in demand for production-type workers will be accompanied by an increase in demand for workers who can coordinate and integrate activities, as technological change generates larger and more complex systems. Davis[38] continues this line of thinking, but he suggests that the new manager functions will have to include broader activities (socio-technical) than were present in the manager functions of the traditional industrial sector. Rezler[39] feels that personnel managers will be particularly affected by technological change. It will require them to become more and more involved in anticipating the possible employment effects of automation and in establishing adjustment mechanisms to aid workers' and firms adaptations to the change.

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[32] Kirsh (64:19.00)

[33] Golodner (73:1.00)

[34] Burack and Pati (70:2.00)

[35] Rezler (64:27.50)

Two writers point to a decrease in demand for middle managers, supervisors and clerical staff, as computers take over many of their traditional activities. Michael[40] sees a general upgrading of skills in both white collar and blue collar jobs, with more demand for paraprofessionals, but with a decrease in demand for supervisory personnel, including middle management, as cybernation moves into these activities. Whisler[41] studies the impact of computerization on supervisors and clerks in life insurance firms. He concluded that computers narrowed and made routine the job content for these personnel and reduced the number of persons required for these activities.

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[36] Drucker (73:0.75)

[37] Carter (66:14.00)

[38] Davis (71:2.40)

[39] Rezler (72:15.00)

[40] Michael (67:13.00)

Technological Change and Age, Ethnic, and Sex Groups

In general, studies conclude that older and younger workers, minority groups and female workers suffer employment problems because of technological change. For older workers the problem is mainly one of skill obsolescence and inability to adjust readily; however, many writers see older unskilled workers as being displaced primarily because unskilled workers in general are being displaced. For younger workers, minorities and females, the normal view is that they suffer relatively more as unskilled workers in general are displaced, because they tend to be more heavily concentrated in the unskilled areas. Exceptions to these views do exist and will also be discussed.

Dunlop,[42] Froomkin[43] and an International Colloquium[44] all expressed the view that older workers are encountering employment problems as a result of increased automation and mechanization. Dunlop believes the two major problems encountered by older workers are increased educational requirements for jobs and the personal and social costs of occupational and geographic movement. The International Colloquium concluded, on the basis of statistical evidence, that automation is making it progressively more difficult for older workers to adjust their life styles to meet changing employment requirements. Dalton and Thompson[45] looked at 2,500 design and development engineers affected by technological change in six technology-based firms and found that the skills of older engineers were becoming obsolescent earlier and earlier in their careers.

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[41] Whisler (70:18.00)

[42] Dunlop (66:20.00)

[43] Froomkin (66:23.00)

[44] Age, Work, and Automation (70:0.10)

Schultz and Weber[46] and Gerber,[47] and Burack and McNichols[48] all found automation affecting older workers and younger workers. Gerber found both older workers and younger workers in automated companies, as compared to these groups of workers in non-automated companies expressed greater job alienation and dissatisfaction. The only difference was that older workers found their work somewhat more meaningful than did younger workers. Burack and McNichols found older supervisors and younger technical workers to be significantly affected by technological change.

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[45] Dalton and Thompson (71:2.00)

[46] Schultz and Weber (64:29.00)

[47] Gerber (65:6.00)

[48] Burack and McNichols

Nelson, Peck, and Kalachek,[49] and Meshel[50] found older workers encountering employment problems due to technological change; but, contrary to the conclusions in other studies, their conclusion was that younger workers were not being adversely affected. Nelson, Peck, and Kalachek found the labor market to be quite flexible and able to handle the re-employment of displaced workers, except for older workers whose skills are specific for current jobs and who are not quickly rehired. Meshel found older workers to be at a disadvantage to younger workers who have acquired more technological sophistication.

Faunce,[51] Kheel,[52] and Herding[53] all feel that younger workers are affected in their employment opportunities by technological change. Faunce feels that teenagers are possibly the only group whose employment has been adversely affected. Kheel feels that younger workers have been affected because they are more heavily concentrated in low or semi-skilled jobs which automation has been eliminating.

Many writers have concluded that minorities, especially Blacks, have suffered significant employment problems due to automation because of their lack of skills and education. These writers include Kheel,[54] Bloice,[55] Young,[56] Zeisel,[57] Puryear[58] and Porchkis.[59] Young draws his conclusions from studies which show that automation will eliminate unskilled and service-type jobs in which Blacks are heavily concentrated. Porchkis feels that non-white workers' lack of education and the fact that seniority clauses tend to favor more established white workers will hurt the employment chances of non-whites as automation eliminates jobs. Zeisel, for example uses textile mill data which points to automation, eliminating simple jobs held by unskilled workers and thus adversely affecting the employment of Blacks.

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[49] Nelson Peck and Kalachek (67:14.00)

[50] Meshel (70:11.70)

[51] Faunce (68:4.00)

[52] Kheel (66:32.00)

[53] Herding (72:6.50)

Padfield and Martin[60] conclude that the employment opportunities of Blacks, Indians and Mexican-Americans are all lowered by technological change in agriculture. Their results are based on an extensive study of the citrus, cotton and lettuce industries in Arizona. Minorities will suffer as demand for farm workers is lowered; because of their lack of skills and cultural differences they cannot easily find re-employment in other activities. The study looks at the problems of each ethnic group separately.

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[54] Kheel (66:32.00)

[55] Bloice (72:1.75)

[56] Young (70:20.00)

[57] Zeisel (68:21.00)

[58] Puryear (66:48.00)

[59] Porchkis (66:47.00)

[60] Padfield and Martin (65:13.00)

Not all writers are as pessimistic as Padfield and Martin are in their outlook on technological change and jobs for minorities. Shultz and Weber[61] found that Mexican-Americans and Blacks had successful retraining and rehiring experiences after a plant shutdown. Boggs, in a speculative article,[62] actually predicts that Blacks will benefit in employment from cybernetic advances. He feels that cybernation is decreasing the number of technical jobs held largely by whites and creating more political-social interaction. He argues that the Blacks have been the largest group to move into education and into social service and civil service jobs and these jobs will be enhanced by cybernation, thus the Blacks will gain by change.

In the area of female employment and technological change, Baker[63] concludes that over the last two centuries changing technology has led to the creating of more and more job opportunities for women. In a 1972 article, Agassi[64] concludes that the trend toward automated plants is a danger to job opportunities for women, because women possess inferior skills and are concentrated in industry's most backward sections. A 1970 study by the Women's Bureau, Wage and Labor Standards Administration of the U.S. Dept. of Labor[65] concluded, from various industry studies, that while job opportunities have increased greatly for women, it is difficult to credit this change to technological advance.

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[61] Shultz and Weber (64:29.00)

[62] Boggs (66:5.00

[63] Baker (64:2.00)

[64] Agassi (72:1.50)

[65] U.S. Dept. of Labor (70:17.70)

Technological Change and Jobs by Industry and Occupation

This section will present representative studies concerned with the impact of technological change on employment in specific industries and occupations. Three studies analysing several industries show the employment impact of technological advance to be very slight. A U.S. Dept. of Labor study[66] concluded this after studying 36 industries in mining, construction, manufacturing and transportation. A University of California, Berkeley study[67] of steel, aerospace and banking industries reached similar conclusions. Horowitz and Herrnstadt[68] concluded that the impact on skill requirements of technological change had been remarkably small in the five industries studied--Meatpacking, Rubber Tires, Machine Shops, Banking, and Medical Services. They found considerable change in skills needed for various occupations; but they found that, in the aggregate, these tended to balance out and give a small net change.

Studies by Shultz and Weber[69] and Young[70] of workers displaced by meatpacking plant shutdowns in the early 1960's show that while many workers found re-employment quickly, displacement problems persisted for many workers. A study in the Monthly Labor Review[71] concerning the Studebaker plant shutdown in South Bend, Indiana found substantial re-employment problems existed for displaced workers five months after the shutdowns occurred in the early 1960's, before the economy had regained full employment growth.

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[66] U.S. Dept. of Labor (66:12.00)

[67] Univ. of Calif., Berkely (66:13.00)

[68] Horowitz and Herrnstadt (66:28.00)

[69] Shultz and Weber (64:29.00)

[70] Young, (63:19.00)

Three studies--Bureau of Labor Statistics[72] in 1972, Rehmus[73] in 1971 and Levine[74] in 1969--concerning railroad employment concluded that technological change has contributed greatly to a declining number of jobs in the industry; but because of successful adjustment mechanisms, little unemployment has resulted. Similarly, three studies of longshoremen's employment--two by Goldberg[75] and one by Hartman[76]--concluded that while technology had greatly affected work activities, it had not caused displacement of workers, because of the use of good adjustment mechanisms. Hartman points out that union members were better off after technological change: their work had been transformed from casual, hard, physical labor into partially mechanized activities. Goldberg also concluded that employment among regular seamen had remained constant; but Warner[77] found that job opportunities were decreasing for unskilled seamen while increasing somewhat for higher skilled seamen. (The Warner study of 1965 was six years earlier than the Goldberg report.)

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[71] Monthly Labor Review (64:22.00)

[72] B.L.S., Dept. of Labor (72:2.00)

[73] Rehmus (71:6.50)

[74] Levine (69:14.00)

[75] Goldberg (71:3.50 & 68:5.00)

[76] Hartman (69:10.00)

[77] Warner (65:21.00)

Three reports on the printing industry agree that technological change has caused major changes in job content and needed skills; but it has caused little unemployment because there have been both growth in demand for output and successful adjustment mechanisms. Critchlow[78] used several case studies, while Kelber and Schlesinger[79] relied on past, present and projected employment trends for American printing trades. The third report was for printing trades in Australia,[80] and it relied on case studies. Two studies of the automation of the Internal Revenue Services, Atlanta office, found little displacement of workers, mainly because there had been advanced planning for adjustment. This was true in the early stages of change (as reported by a Bureau of Labor Statistics bulletin[81]) and also at the final stages of the change (as reported by Rothberg[82] in 1969).

Lewis[83] points out that mechanization of coal mining has increased the employment opportunities and improved the working conditions of younger, better educated workers. Vickery[84] concludes that for laundry and cleaning firms growth in the industry will more than offset any decreases in number of jobs caused by technological change. O'Carrol[85] finds that technology is eliminating jobs in the nonelectrical machinery industries, and the rate of expansion of the industry is expected to decline; therefore, manpower needs can be expected to decline.

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[78] Critchlow (70:3.00)

[79] Kelber and Schlesinger (67:11.00)

[80] Australia, Dept of Labour and National Service (69:0.75)

[81] B.L.S., Dept. of Labor (63:4.00)

[82] Rothberg (69:16.00)

[83] Lewis (69:16.00)

All studies seem to agree that technology has significantly displaced workers and resulted in unemployment in agriculture. Schmitz and Seckler,[86] Cargill and Rosemiller,[87] Bishop[88] and Day[89] all report declining demand for farm workers and/or migration of workers in various regions and for various crops. Fulco[90] and Dow[91] agree on the employment effect for unskilled farm workers; but they point out that the demand for skilled workers has increased and will continue to increase, perhaps as much as 100 percent. Fulco also states that the demand for women and young persons will be increased for employment as sorters in field sheds.

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[84] Vickery (72:21.00)

[85] O'Carrol (71:6.25)

[86] Schmitz and Seckler (70:13.40)

[87] Cargill and Rosemiller (69:2.50)

[88] Bishop (67:4.00)

[89] Day (67:8.25)

[90] Fulco (69:8.00)

[91] Dow (70:3.65)

In 1963, Fox[92] expressed fear that automation was decreasing clerical-worker demand; however, in 1971 Robinson[93] found that clerical-worker demand had increased, although he conceded that it might have increased even more had there not been automation. A study in The Office,[94] based on a poll of 200 personnel officers, predicted that the number of jobs for office workers in general would increase as a result of automation.

Two studies show technological change reducing the number of jobs in two of the transportation industries. Levinson[95] found some displacement of teamsters because of technological advances in trucking; however, he found the workers and union to be very favorable inclined toward accepting technological improvements. Kahn[96] concludes that technological change has been rapid in the airline industry and has greatly reduced the need for non-pilots on the flight decks of airplanes.

These industry and occupation studies point out the different impacts produced by technological advances on various areas of the economy, while they express the differing opinions of writers concerning the actual impact of change on employment. One fact that stands out is that while many areas show no decline in the number of jobs becuase of automation, little is known about how many jobs which might have been generated were not generated because of the change. Many studies are based on net employment figures which do not show what happened to individual workers during the automation phase; however, many studies do indicate that early forecasts greatly overestimated the extend to which technology would change skill and job requirements.

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[92] Fox (63:5.50)

[93] Robinson (71:7.25)

[94] The Office (65:12.00)

[95] Levinson (71:4.75)

[96] Kahn (71:4.25)

Other Relationships between Workers and Technology

An article in the American Federationist[97] develops the thesis that for the American worker, a significant part of the employment effect produced by technological improvements is created, when American business exports the new technology. The use of the advanced technology and capital in lesser developed nations with low-wage workers is said to undercut the American workers' jobs.

From a comparative systems view, several article argue for the ability of planned economies (such as the U.S.S.R. economy) to handle the re-employment ofdisplaced workers much more easily than capitalistic economies can. Representative of these arguments are articles by Korsakov[98] and Maevskii.[99] Korsakov discusses the successful adjustment of Soviet workers displaced by automation of seaport activities. Maevskii argues his case on a general conceptual basis.

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[97] Samuel (71:8.00)

[98] Korsakov (72:14.00)

[99] Maevskii (69:18.00)

Finally, a short discussion needs to be developed concerning worker satisfaction and psychological well-being resulting from technological change. These matters are not the concern of this study; but they obviously are closely connected, since they affect worker welfare and community well-being. Several references were made earlier in this paper to workers' acceptance of technological change; so now a few articles concerning worker dissatisfaction with change will be noted. Several articles point out the potential for increased worker insecurity and lessened psychological satisfaction. Knecht expresses the view in the American Federationist[100] that the human impact of change must be carefully considered before change is made, because it will be too late to help after the fact. Winpisinger[101] points out that dissatisfaction is greatest with younger workers and least with older workers. Sheppard[102] concludes that job alienation is greater among blue-collar than among white-collar workers, because blue-collar jobs have been made more rigid and routine by automation. Finally, McNiff[103] points out that displaced workers who successfully adjust and remain employed or are re-employed can undergo tremendous trauma and stress in the process.

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[100] Knecht (72:13.00)

[101] Winpisinger (72:22.00)

[102] Sheppard (72:18.00)

[103] McNiff (70:9.50)

CHAPTER 3

ADJUSTMENT MECHANISMS

EXPERIENCE AND EVIDENCE

Introduction

The purpose of this chapter is to review discussions of and critiques of the value of various public and private adjustment mechanisms used to aid workers affected by technological change. The basic conclusions, as presented in Chapter II of the review of the literature concerning technological change and employment was that massive or even substantial unemployment had not occurred as the economy experienced technological advances over the last two decades. Some authors thought this was because the impact of technological change on actual skill requirements and work activities was not nearly as great as many had predicted it would be. Even if job content and activities were affected, technological change did not result in any significant change in the skills needed to perform the "new" job. Also, several studies pointed to a reduction in the level of actual skills needed (at least on the average) on the job as technology advanced.

Other writers found that the miminal employment effects were due to the mobility and flexibility of the labor force and to the presence of a number of good adjustment mechanisms. An essential feature needed to allow labor mobility and adjustment mechanisms to facilitate labor adjustment is full employment. Many studies have stressed that full employment growth is a basic requirement, because workers must have effective and approximately equal employment opportunities before labor mobility and adjustment mechanisms will function smoothly.

Several articles gave a great deal of attention to the importance of promoting full employment growth as a means to negating the impact of technological change. Weinburg,[1] Jaffe and Froomkin,[2] Mangum[3] and Goodwin[4] are representative of these views. One of the main conclusions of Weinburg and of Jaffe and Froomkin is that any unemployment caused by technological change can be offset by increasing levels of aggregate demand in the economy. Goodwin argued that is there is effective demand for labor, existing national programs of counseling and information can be effective in facilitating the adjustment of many displaced workers. As a specific example, Critchlow[5] concluded that there have been large, labor-saving effects of new technology in printing; but the growth in demand for the product has balanced out these savings. Takahashi's[6] study found that technological advance in Japan from 1955 to 1965 had a drastic impact on the female job sturctures; but because of the high rate of economic growth, little dislocation of women workers occurred. Nelson, Peck and Kalachek[7] concluded that during the 1947-1965 period, evidence indicates that enhanced technological change, itself, usually led to more rapid economic growth and increased employment.

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[1] Weinburg (70:17.85)

[2] Jaffe and Froomkin (68:6.00)

[3] Mangum (66:35.00)

[4] Goodwin (65:6.50)

[5] Critchlow (70:3.00)

[6] Takahashi (69:19.00)

Many other studies, while advocating use of additional public adjustment mechanisms, have stressed the importance of maintaining a full-employment goal and policy.[8] These studies include that of the National Commission on Technology, Automation, and Economic Progress[9] and that of the National Industrial Conference Board.[10] The latter study criticized the Commission for not giving more attention to private adjustment mechanisms but agreed on the need for full employment. Siemuller[11] believes that technological change had a large effect on employment and jobs, but that it was neutralized by high economic growth rates spurred by large defense expenditures and a population heavily skewed toward young adults who have high consumption rates. Crispo[12] and the Department of Labour[13] in Canada have advocated full employment policy to help neutralize the employment impact of technological change for Canadian workers.

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[7] Nelson, Peck, and Kalachek (67:14.00)

[8] See, for instance:
Bell (71:1.00)
Kassalow (70:8.00)
Barkin (66:4.00)
Wolfbein (70:19.00)
Freomkin (66:23.00)
Eckstein (66:21.00)
Buckingham (66:11.00)

[9] National Commission (66:41.00)

[10] NICB (66:42.00)

[11] Siemuller (70:17.20)

Many studies and writers conclude that if full employment has been maintained, collective bargaining and labor-mangement cooperation has taken care of and will continue to take care of all or a vast number of the employment problems generated by advances in technology. Aronson[14] while stressing the need for full employment and recognizing that automation rarely radically changes occupational structures, concluded that private collective bargaining has been able and will be able to handle by far the largest part of the adjustment activity. Perline and Tull[15] found that collective bargaining is the only viable route available for labor to take as it attempts to ameliorate the problems caused by automation. Davey,[16] Weber[17] and MacDonald[18] all concluded that collective bargaining plays a vital, positive role in the successful adjustment to technological change. Davey does caution, however, that the use of restrictive, outmoded work practices are not in the best interest of unions nor of the economy. MacDonald states that, while not perfect, collective bargaining has shown remarkable flexibility and adaptablility to new and often trying circumstances.

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[12] Crispo (68:1.00)

[13] Canada, Dept. of Labour (67:7.00)

[14] Aronson (65:0.50)

[15] Perline and Tull (69:25.00)

[16] Davey (72:4.00)

[17] Weber (68:20.00)

[18] MacDonald (67:12.50)

Many articles have pointed out the ability of collective bargaining to handle the impact of technology on workers in specific industries The transportation industries are among the most studied areas of the economy. For the transportation group as a whole, Levinson[19] concludes that collective bargaining has achieved a reasonably high degree of success in dealing with the problems of labor displacement and manpower adjustment presented by the technological developments of the period covering 1940-1970. Goldberg[20] and Hartman[21] both find union-management negotiation to have been and to be a good method of handling adjustment to change in the American longshoremen sectors. Levinson[22] argues that bargaining at the national level is best suited for the teamsters and trucking industry and allows for the absorption of technological change within the industry.

Rehmus[23] and Levine[24] point out that while the railroad industry has had bargaining difficulties and recurring crises, the unions and industry have accommodated through an array of contract clauses, the smooth adjustment of the existing work force to automation in the face of large decreases in the number of jobs available. Rehmus also points out that these problems and negotiations have not impeded in any significant way the introduction of improved technology; also, these adjustments have been accomplished in a unique collective bargaining setting, in that public policy does not acknowledge the right of workers in the railroad industry to strike. Kahn[25] and Bowers[26] find that evidence shows collective bargaining to have been an effective instrument for working out methods of handling technological displacement on the flight deck in the airline industry, some of the gains from increased productivity have been used to compensate those affected

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[19] Levinson (71:4.70)

[20] Goldberg (71:3.50 & 68:5.00)

[21] Hartman (69:10.00)

[22] Levinson (71:4.75)

[23] Rehmus (71:6.50)

[24] Levine (69:14.00)

Studies in the printing industry[27] discussed in Chapter I case studies of telephone operators by the U.S. Dept. of Labor,[28] and a study of electric and gas utilities by the U.S. Dept. of Labor[29] and an analysis of the non-electrical machinery industry by O'Carroll[30] have shown that union-management agreements and cooperation have negated or largely softened the impact of technological change on workers. A number of these

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[25] Kahn (71:4.25)

[26] Bowers (65:3.00)

[27] Critchlow (70:3.00) Kelber and Schlesinger (67:11 00)
Australia, Dept. of Labour and National Service (69:0.75)

[28] U.S. Dept. of Labor (68:19.50)

[29] U.S. Dept. of Labor (65:20.60)

[30] O'Carroll (71:6.25)

In many areas of the economy, studies show collective bargaining and management-labor cooperation to have handled and to be handling adjustment problems quite satisfactorily. Many writers seem to feel that all that is needed to establish effective adjustment mechanisms for technological improvements is the private collective bargaining process (along with full employment growth); but not all workers are unionized, and not all unions are reported as being effective vehicles for establishing smooth working adjustment mechanisms.[34] In fact, some authors feel that unionization in general has suffered from automation and that unions cannot effectively aid workers displaced by new technology.[35] Some studies point out and caution that privately established adjustment mechanisms have or could have damaging effects on the economy, the industry and workers, at least in the longer run.[36]

Many writers have pointed out that public policies have been developed and need to be further developed in order to augment and strengthen private adjustment mechanisms which attempt to aid workers in regions, industries and occupations and of demographic groups that have suffered from technological displacement. These writers also wish to guard against private solutions that they believe are detrimental to the economy as a whole. Section two of this chapter will discuss various public policies and programs that have been used and will cite evidence concerning the contribution these public mechanisms have made to aiding displaced workers' adjustments. Public manpower programs are discussed in detail in a later chapter. Section three of this chapter returns to privately established adjustment mechanisms. It contains discussions of various specific types of adjustment mechanisms and cites evidence concerning the relative value of and use of the differing methods.

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[34] For example see: Buckingham (66:11.00); Aronson (65:0.50); and Herding (72:6.50) plus refer to material in Chapter I on minorities, ages and sex groups, on agriculture, and plant closings.

[35] For example, see:
Retzler (66:50.00), King (72:12.00)

[36] For example, see:
Mortimer (71:4.90), Davey (72:4.00)

Publicly Established Aids to Displaced Workers

For discussion purposes, the various public policies and programs to aid workers displaced or threatened by new technology will be divided into five basic groups as was done in the discussion of conceptual public policies in Part I. The five groups are aggregate demand and job creation; labor market information, placement and planning; education, training and relocation; income and work opportunities; and union-management relations.

1. Aggregate Demand and Job Creation

The role that full employment growth plays in the adjustment process as discussed in the literature has been reported on in the first section of this chapter. Many writers and study groups have advocated, as did the Report of the National Commission on Technology, Automation, and Economic

Progress,[37] the continued active use of fiscal and monetary policy to promote economic growth. These include Bell,[38] Gordon,[39] Kassalow,[40] Wolfbein,[41] Jaffe and Froomkin,[42] Sheppard,[43] the National Industrial Conference Board,[44] and Bolz.[45]

The California Commission on Manpower, Automation, and Technology[46] also stressed the need for active use of fiscal and monetary policies to support economic growth; but this commission concluded that then current efforts, public and private, were inadequate to deal with the current or projected problems to be generated by new technology. Nathan[47] argues for the use of fiscal and monetary policies, and he also stresses the need for income redistribution to aid economic growth and worker adjustment to change. Jaffe and Froomkin[48] also discuss the use of automatic stabilizers as an aid to maintain aggregate demand and growth.

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[37] National Commission (66:41.00)

[38] Bell (71:1.00)

[39] Gordon (65:6.60)

[40] Kassalow (70:8.00)

[41] Wolfbein (70:19.00)

[42] Jaffe and Froomkin (68:6.00)

[43] Sheppard (66:55.00)

[44] NICB (66:42.00)

[45] Bolz (66:6.00)

[46] Calif. Commission (64:6.00)

[47] Nathan (66:40.00)

One fiscal policy would be the direct creation of jobs by the government in some form of a public employment program; many articles include this as means of worker adjustment to automation.[49] Puryear[50] feels a public works program is essential to aid Blacks who, he finds, are hard hit by technological change. Some writers such as Nelson, Peck and Kalachek[51] believe the labor market is flexible enough to handle most adjustments, so public employment as an aid for displaced workers will be needed only in short periods of extremely rapid technological change. Other writers such as Sheppard[52] predict a general decrease in job opportunities as higher levels of technology and see public employment as a growing permanent feature of the economy.

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[48] Jaffe and Froomkin (68:40.00)

[49] See for instance:
Sexton and Sexton (71:8.25)
Siegeland Belitsky (70:17.20)
Jaffe and Froomkin (68:6.00)
Michael (67:13.00)
National Commission (66:41.00)
NICB (66:42.00)
Calif. Commission (64:6.00)

[50] Puryear (66:48.00)

[51] Nelson, Peck and Kalachek (67:14.00)

[52] Sheppard (66:55.00)

To augment national, aggregate programs and full employment policies,[53] many studies have pointed to the use of regional urban programs and policies which help ensure that all areas of the economy benefit. Goodwin,[54] while discussing several national programs which aid worker adjustment to technological change, points out the need for localized plans and programs to be used simultaneously to meet the individual and community needs caused by displacement. Salner[55] points out that displacement from automation often hits one area harder than it hits others; thus a need for regional policies and programs exists. He feels that the local U.S. Employment Service Office should be the agency to meet those particular community needs.

Several writers and studies[56] have also mentioned the use of shorter work weeks, job-sharing and early retirement programs to be established by the government to help maintain employment opportunities for all workers or for younger workers. These writers are usually assuming that technological improvements lead to fewer job opportunities. Dunlop[57] discusses the use of shorter working hours and job sharing as other methods of helping

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[53] See, for example:

Maikov (69:18.00)	Eckstein (66:21.00)
National Commission (66:41.00)	NICB (66:42.00)
Sheppard (66:55.00)	Calif. Commission (64:6.00)

[54] Goodwin (65:6.50)

[55] Salner (17.00)

[56] Calif. Commission (64:6.00) Maikov (69:18.00)
National Commission (66:41.00) Rosenberg (66:51.00)

[57] Dunlop (66:20.00)

maintain employment for older workers, who, he feels, are particularly hard hit by automation. Michael[58] in his discussion of shorter working hours states that increased leisure time will cause readjustment problems for many people who are unaccustomed to large amounts of free time.

These studies discussing the use of a shorter work week and job sharing as a method of handling labor displacement problems tend to be concentrated in time up to the mid 1960's. Only a few references published since the mid 1960's have discussed shorter work weeks as an adjustment mechanism for automation. This may have resulted from the strong full employment growth the economy experienced over the 1960's, which is taken as proof that job sharing is really not needed if proper aggregate demand can be maintained.

2. Labor Market Information, Placement, and Planning

A large number of studies[59] have discussed the need and value of public counseling and placement programs to aid workers displaced by automation and mechanization. Studies by the U.S. Dept. of Labor,[60] Salner[61] and Bolz[62] all consider the value of counseling for workers affected by change

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[58] Michael (67:13.00)

[59] Examples include:

B.L.S., Dept. of Labor (66:12.00)	Weinberg and Ball (67:23.00)
National Commission (66:41.00)	Schultz and Weber (64:29.00)
Calif. Commission (64:6.00)	

[60] U.S. Dept of Labor (68:19.50)

[61] Salner (65:17.00)

[62] Bolz (66:6.00)

cite examples of its use. Puryear[63] cites the need for improved public counseling programs to aid Blacks affected by technological change. Zeisel[64] points to the need for enhanced placement systems to aid Blacks who are displaced when higher levels of technology are introduced into textile plants. Two studies point to the use and need for more counseling and placement effects for older workers. These are by Nelson, Peck, and Kalachek,[65] and Dunlop[66] who point out that counseling can be combined with early retirement options to make early retirement a feasible, flexible option for some older workers.

Goodwin[67] and Stern[68] point out that counseling and placement programs can be very effective in aiding the adjustment and of displaced workers if full employment is being maintained. On the other hand, early counseling conducted by trained, experienced personnel can do much for the morale and general welfare of displaced workers, even if it makes little difference in their chances of finding immediate re-employment.

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[63] Puryear (66:48.00)

[64] Zeisel (68:21.00)

[65] Nelson, Peck and Kalachek (67:14.00)

[66] Dunlop (66:20.00)

[67] Goodwin (65:6.50)

[68] Stern (69:31.00)

In order for placement, referral and counseling to be of benefit to displaced workers seeking re-employment advanced planning and information systems are essential. Planning and information are obviously basic for manpower training and relocation programs (to be discussed in the next section) to be successful. Several studies discuss planning and information flows;[69] others concentrate more on the planning aspect[70] or on the information system needs.[71]

Stern[72] in his study of a meatpacking plant shutdown concluded that preshutdown planning is vital to the success of any manpower adjustment program. Salner,[73] too, expresses the need for planning by the local U.S. Employment Service in order to establish effective counseling and placement services for displaced workers. Dow[74] points out that while mechanization will cause much worker displacement in the Florida citrus industry, the time lead is sufficient for planning, if used, adequately to overcome the adjustment problems. Goodwin[75] points out that with full-employment, existing information flows allow present counseling programs to be an effective adjustment tool. Maevaskii[76] discusses the need for planning for the use of manpower resources in a planned economy such as the U.S.S.R.

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[69] For instance:
Bowers (65:3.00)
Porschkis (66:47.00)
Puryear (66:48.00)
National Commission (66:41.00)

[70] For instance:
Reisman (71:7.00)
Bell (71:1.00)
Walker (66:62.00)
Barkin (66:4.00)

[71] For instance:
NICB (66:42.00)
Wolfbein (70:19.00)
Aronson (65:0.50)
Larkin (70:9.30)
Nelson, Peck and Kalachek (67:14.00)

[72] Stern (69:31.00)

[73] Salner (65:17.00)

[74] Dow (70:3.65)

3. Education, Training and Relocation

The relationship between technological change and the role of education in aiding worker adjustment is one of the most discussed and, to a much lesser extent, most analysed areas. The recommended goal of education in relation to technological change is to provide a good basic, broad education for all in order to maximize the individual's potential for acceptance and successful adjustment to change.[77] Dunlop[78] advises that continuing education for all workers is necessary to achieve this goal. Rosenburg[79] feels that education should be directed towards familiarizing students with automation and its effects, so they would be prepared to deal with it; however, Prasow and Massarik[80] in their 1967 review of the literature, while agreeing with the need for education to aid workers' adjustment, pointed out that there seemed to be little agreement as to whether the education should be broader, more comprehensive, more specialized, or some combination of these. Mueller et al.[81] in their survey of 2662 workers from all industries found that having higher levels of formal education make workers in general, more adaptable to new technology. Several studies[82] in this area urged the expanded use of basic adult education and broader education to aid unskilled and minority workers and their children to adjust better when threatened by automation and mechanization.

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[75] Goodwin (65:6.50)

[76] Maevaskii(69:18.00)

[77] For example, see:
Manpower Adm., U.S. DOL (68:9.00)
Kassalow (70:8.00)
BLS, U.S. DOL (66:12.00)
NICB (66:42.00)
National Commission (66:41.00)

[78] Dunlop (66:20.00)

[79] Rosenburg (66:51.00)

[80] Prasow and Massarik (69:26.00)

Burack and McNichols[83] advocate the use of refresher university programs to update managers on advanced technological innovations, and Drucker[84] points to highly educated professionals as the men at the forefront of the technology revolution. Drucker does warn, however, that work activities and demands must live up to the expectations of the highly educated people. Bright,[85] on the other hand, warns against "excessive educational responses" to automation: if the education received is not needed, it will only build disillusion and resentment among workers.

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[81] Mueller et al. (69:23.00)

[82] Puryear (66:48.00) Korsakov (72:14.00)
Porschkis (66:47.00) Padfield and Martin (65:13.00)

[83] Burack and McNichols (68:0.50)

[84] Drucker (73:0.75)

[85] Bright (66:9.00)

Several writers[86] have looked at voactional education as an aid for displaced workers and as a hedge against their displacement; however, several warnings concerning the use of vocational education have been published. Fulco[87] concludes that public vocational programs have missed those hardest hit of the disadvantaged, the rural farm worker. Bishop[88] goes further and states that vocational education for farm workers has been largely misguided, with too much emphasis placed on farm-oriented aspects. The OECD[89] warns that specific vocational education may be obsolete by the time the training is completed. Finally, the Mueller et al. study[90] concludes that specific, on-the-job training seems to prepare workers better for new jobs than does general vocational education.

Reisman,[91] Michael[92] and Laucks[93] all write in a futurists vein and recommend the use of education to adapt man to the successful use of his growing leisure time in the post-industrial society. Michael feels education must become more of a continuous life-long process, both for job retraining and for personal fulfilment to make leisure more meaningful. Laucks feels that education should not be directed only towards making a living, but also towards stimulating the person's curiosity to explore his universe. Nathan[94] also believes education needs to take on a new role; but for him, it must be revoluntionary changes in education that will lead society towards a socialistic system.

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[86] For instance;
Faunce (68:4.00), Levine (69:14.00)

[87] Fulco (69:8.00)

[88] Bishop (67:4.00)

[89] OECD (66:45.00)

[90] Mueller et al. (69:23.00)

[91] Reisman (71:7.00)

[92] Michael (67:13.00)

[93] Laucks (64:34.00)

The use of public manpower programs and training to aid worker adjustment to technological change is often encountered in the literature; however, differing views are encountered concerning the actual role manpower programs can and should take in aiding workers' adjustment to change. The literature on manpower programs is not concentrated in any one time period, but rather evenly distributed over the early, middle, and late 1960's and in the early 1970's. Most of the literature concludes that full-employment and collective bargaining can handle most of the displaced-worker problems, and that manpower programs, placement, counseling, and broader education can be used as complementary tools to handle the remaining problems, especially those outside of collective bargaining.[95] Many of these studies, such as Berenschot's[96] while agreeing on the need for improved training, argue that sufficient training facilities of the proper type are not yet available here or in Europe.

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[94] Nathan (66:40.00)

[95] For instance, see:
Aronson (65:0.50)
National Commission (66:41.00)
Weinberg (70:17.85)
Mangum (66:35.00)
Wolfbein (70:19.00)
Berenschot (67:3.00)

[96] Berenschot (67:3.00)

Kassalow[97] concludes, contrary to others, that automation is seriously hurting the ability of unions to use collective bargaining to establish adjustment mechanisms. He feels this means public policy should do more, including retraining, to aid the development of the supply of labor. A U.S. Dept. of Labor, Manpower Administration study[98] concludes that if technology is adopted on a gradual basis, it usually will not require any outside aids for worker adjustment; however, if a drastically different technology is implemented manpower programs will probably be needed to aid some displaced workers. Bright[99] cautions against focusing on just one narrow aspect of technology change such as skill requirements, and against excessive training to upgrade skills; he feels the new technologies being adopted are not significantly increasing skill requirements.

Several studies have concluded that manpower programs are a necessary part of the adjustment mechanism for certain more disadvantaged workers such as older workers[100] and Blacks.[101] Zeisel[102] concludes that the federal government must play a major role in helping unskilled workers, especially Blacks, who will be displaced by technological change in the textile industry. A major part of this aid should be in the form of retraining programs for the industry. Bishop[103] also advocates the use of manpower programs to aid in the adjustment of displaced farm workers; however, he concludes that to date there has been no explicit manpower policy for farm labor, and most of the training efforts have been inappropriate since they were not geared to training for outmigration to non-farm jobs.

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[97] Kassalow (70:8.00)

[98] Manpower Adm., U.S. DOL (68:9.00)

[99] Bright (66:9.00)

[100] Nelson, Peck and Kalachek (67:14.00) Meshel (70:11.70)
Dunlop (66:20.00)

[101] Puryear (66:48.00)

[102] Zeisel (68:21.00)

Fulco,[104] in his study of farm workers, states that public manpower programs will continue to be the main vehicle for retraining farm workers, and he is optimistic about the use of programs such as MDTA. Goodwin[105] concluded, after studying several national manpower programs, that the Manpower Development and Training Act has been effective in retraining technologically displaced workers. Korsakov[106] discussed the successful retraining of unskilled dockworkers in the U.S.S.R. which helped them make a smooth transition to more mechanized work procedures.

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[103] Bishop (67:4.00)

[104] Fulco (69:8.00)

[105] Goodwin (65:6.50)

[106] Korsakov (72:14.00)

A number of studies[107] have discussed the use of public relocation programs as an additional adjustment to technological change. The basic concept involved is that technological change and aggregate demand stimulation affect job opportunities in an unequal manner among various regions; therefore workers need to be mobile. When the literature that discusses public supported relocation is reviewed, the almost complete lack of material in the latter 1960's and 1970's, especially material in the United States, comes as somewhat of a surprise. This is true despite discussions concerning the need for relocation by the National Commission on Technology, Automation, and Economic Progress,[108] the National Industrial Conference Board[109] and the California Commission on Manpower, Automation, and Technology.[110] Relocation supported by public agencies and funds has been a rarely used adjustment mechanism in the United States and, based on present literature, appears still to have a low priority.

Two studies, one by Seligman[111] published in 1964 when the economy had experienced a long high unemployment period and the others by Wolfbein[112] published in 1970 when the economy had experience a long full-employment growth period, agree that technological change has caused and will cause serious worker displacement in some sectors and regions of the economy, and that public relocation programs are essential to facilitate adjustment. Two studies discuss the relation among technological improvement, economic growth and labor mobility in other nations. One study, by the Canada Department of Labour,[113] concerns Canada; the other, by Maevskii,[114] concerns the U.S.S.R. Both articles conclude that mobility is required along with technological change for industrial growth to occur, and that workers must become accustomed to the idea of mobility. They also stress that government has a responsibility to aid the required worker relocation. The Canadian article discusses the use of government assistance loans to displaced, established auto workers as set up in contract agreements including the U.A.W., the auto producers and the government.

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[107] For example, see:
Dunlop (66:20.00)
Mangum (66:35.00)
OECD (66:45.00)
Puryear (66:48.00)
Aronson (65:6.50)

[108] National Commission (66:41.00)

[109] NICB (66:42.00)

[110] Calif. Commission (64:6.00)

[111] Seligman (64:31.00)

[112] Wolfbein (70:19.00)

4. Income and Work Opportunities

Various discussions and proposals for income maintenance systems (negative income tax, guaranteed annual income, unemployment compensation) are found in the literature.[115] These writers argue that technological change will cause unemployment, possibly for long terms or permanently, and that to help the ex-worker and stablize the economy income maintenance is needed. Not only is income maintenance advocated for those unable to find employment, but also it is proposed for those who are unable to be fully or adequately employed.

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[113] Canada Dept. of Labour (69:31.00)

[114] Maevskii (69:18.00)

[115] Jaffe and Froomkin (68:6.00)
Michael (67:13.00)
National Commission (66:41.00)
Seligman (66:52.00)
NICB (66:42.00)

Unemployment compensation is discussed as a measure to help maintain displaced workers' earnings as they search the labor market seeking reemployment and/or to aid displaced workers in meeting their spending needs during cyclical downturns in the economy.[116] Issues related to unemployment compensation concern the number of workers covered, the payment size and the number of weeks the payments should be continued, including the use of any extended unemployment benefits periods.

The use of minimum wages as an adjustment for technological change has not received a great deal of attention in the literature, although its use is proposed in a few articles.[117] Poschkis[118] suggests the somewhat novel idea of legislation to prevent moonlighting in order to increase employment opportunities, especially for non-whites.

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[116] Barnes (70:0.50)
Kassalow (70:8.00)
Crispo (68:1.00)
Zeisel (68:21.00)
Dunlop (66:20.00)
OECD (66:45.00)
Goodwin (65:6.50)
National Commission (66:41.00)

[117] For example, see:
Barkin (66:13.00)
Padfield and Martin (65:13.00)
Calif Commission (64:6.00)
National Commission (66:41.00)

[118] Poschkis (66:47.00)

5. Union-Management Relations

Several studies[119] have discussed public involvement in the collective bargaining procedures and/or changes in the legislation affecting the bargaining process. One view is expressed by Seligman,[120] who concludes that unions' responses to technological change have been inadequate and the answer lies in tripartite bargaining involving labor, business and government. The almost opposite view is expressed by Aronson,[121] who concluded that collective bargaining appeared to be handling most adjustment problems, although the use of third party assistance was used in more difficult cases. Levinson[122] concludes that collective bargaining has achieved a reasonably high degree of success in dealing with labor displacement in the transportation industries. To strengthen the collective bargaining process, he suggests that labor legislation should be consolidated so that it is applicable to all major transport sectors. More broadly based bargaining units (perhaps national) should be encouraged and public policy in this area limited. Finally he recommends the standardization fo the scope and applicability of unfair labor practices provisions to improve the knowledge of all parties involved with respect to their position in the bargaining provisions.

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[119] For general reference, see:
National Commission (66:41.00) Calif. Commission (64:6.00)
NICB (66:42.00)

[120] Seligman (70:13.90)

[121] Aronson (65:0.50)

[122] Levinson (71:4.70)

Privately Developed Adjustment Mechanisms

This section presents the current state-of-the-arts concerning the various types of adjustment mechanisms that have been developed at the firm and industry level by management and labor. Included are discussions of the relative use and value of the different mechanisms to the workers and to society. The various adjustment instruments and methods will be grouped in the presentation as they were in Part I: transfer, relocation, and retraining measures; job protection measures; work sharing mechanisms; income security plans; re-employment aids; and bargaining procedures.

Chapter II of Part II and the first section of this chapter outlined the many studies and writers that have concluded that technological change was not creating substantial displacement of workers in the economy. This was attributed to full employment growth in the economy (technological changes having had less impact on skill requirements than had been assumed), to the flexibility of the labor force and to the number of effective adjustment mechanisms that have been developed by labor and management. The number of adjustment mechanisms and the various combinations of these in use in differing industries and firms in the economy is quite lengthy and impressive. While these adjustment aids are missing in some areas and their effectiveness and optimality sometimes questioned, the general conclusion must be drawn that these mechanisms have helped a great many workers in a vast segment of the economy to adjust to the impact of new technology. Management and labor, through cooperation, negotiation and, sometimes through conflict, have allowed the introduction of new technologies while minimizing the potential displacement of workers and compensating many who were displaced, either temporarily or permanently.

1. Transfer, Relocation, and Retraining

The amount of worker adjustment to technological change that is handled by in-plant transfers, transfers between plants and relocation and by on-the-job and in-plant retraining appears to be vast.[123] These more traditional approaches, while not receiving the attention which some of the more dramatic mechanisms such as early retirement, guaranteed annual wages, extended vacations, profit sharing, etc., receive, seem to be handling a much larger amount of the adjustment process. Related issues are maintenance of paygrades with the transfer, plus the use of wider seniority units and relocation allowances to encourage transfer and relocation.

Aronson[124] concludes that technological change has continued to cause declining employment opportunities but that in-plant transfers are more important than labor turnover in worker adjustment to technological change. The O.E.C.D.[125] recommends industry aids to worker adjustment, especially through intra-plant programs of retraining and transfer, as a method to reduce government needs in this area. As a specific example, a U.S. Dept. of Labor study[126] found that orderly transfer to another job was the adjustment ultimately achieved for nearly all displaced employees in a large electric and gas utility firm whose original jobs were affected by a technological change.

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[123] In addition to the literature to be cited individually, the following material represents the literature published since 1965;

Delanmotte (71:3.00)
Stern (71:9.00)
Herman (70:6.00)
Killingsworth (70:9.00)
Wolfbein (70:19.00)
Perline and Tull (69:25.00)
Prasow and Massarik (69:26.00)
Rothberg (69:29.00)
Stern (69:31.00)
Ullman (69:33.00)
Burack and McNichols (68:0.50)
Crispo (68:1.00)

[124] Aronson (65:0.50)

[125] OECD (66:45.00)

The use of between-plant transfers and relocation as adjustment mechanisms can be highlighted by reference to several specific studies. Pichler, in reporting on a case study,[127] states that although there were some mobility problems, the transfer option appears to have afforded the most effective mechanisms for adjustment to plant shutdowns. He found Blacks more likely to transfer than to retrain: this he attributed to frustration with discriminating job security bariers and school practices in their local areas. He also found that for men over thirty the distribution of those accepting transfer showed a flat distribution; this finding contradicts the theory that mobility and acceptance of transfer is negatively related to age. Pichler also found that those workers who chose the transfer option were most satisfied. Lipsky[128] in his study of plant shutdown found that those workers who least needed the aid of adjustment mechanisms were the more likely to relocate, while those workers most likely to benefit from the use of the the inter-plant transfer system were less likely to relocate.

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[126] U.S. DOL (65:20.60)

[127] Pichler (66:46.00 & 67:18.00)

[128] Lipsky (70:9.40)

Robinson[129] and Walker[130] both found significant use of relocation plans to aid office workers displaced by technological change. Walker's conclusions were based on a review of data, surveys and investigations for office workers and telecommunication non-manual workers in Western Europe, United States, Japan, Canada and Australia. Freedman[131] in a study of telephone operators found considerable use of transfers to other offices. This was aided by the various offices' keeping information on each other's needs for replacements and using this information as a basis for transferring workers.

In an earlier study based on several case studies (1963), Weber[132] reported few workers chose the transfer option, but those that did were satisfied with the move. He did find that workers were much more disposed to inter-plant transfer within the same labor market than they were to relocation to a more distant area. A Canadian Department of Labour study[133] based on 471 collective bargaining agreements concluded that the two most important provisions that were drawn up to meet the impact of technological change were retraining and relocation.

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[129] Robinson (71:7.25)

[130] Walker (67:22.50)

[131] Freedman (68:4.50)

[132] Weber (63:18.00)

[133] Canada Dept. of Labour (67:7.50)

One of the deterrents encountered in getting workers to use inter-plant transfers involving relocation is the cost incurred in moving. This cost is both psychological and financial. The psychological costs involve leaving family, friends and a known community in return for the uncertainty of a new job and a new community. The financial costs and, perhaps, part of the psychological costs can be fully or partially offset by the use of relocation allowances by the firm. A number of studies over the last ten years have discussed the value of relocation allowances[134] to stimulate and aid relocation in response to technological change which reduces employment opportunities. The firm in return for this outlay receives less union resistance to change and retains an experienced worker with training specific to the firm's activities.

The use of seniority rules affects workers' use of transfers in two ways. First, the use of wider seniority units is one form of job protection for older workers (to be discussed in the next section), because it gives them the highest priority for job transfer and the ability to "bump out" workers with less seniority. Second, transfers which do not include continuance of old seniority levels and rights may discourage established use of the transfer option. Several studies[135] have discussed the importance of seniority transfer as related to job transfers. Weber[136] and Davey[137] both specifically point to the disposition of seniority rights as an important factor in determining the effectiveness of interplant transfer systems.

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[134] B. L. S., DOL (72:2.00)
Kassalow (70:8.00)
Kheel (66:32.00)
David (64:8.50)
Barbash (63:1.00)
Killingsworth (63:9.00)
Nelson, Peck and Kalachek ((67:14.00)

[135] Killingsworth (63:9.00)
Nelson, Peck, and Kalachek (67:14.00)
Taft (63:16.00)
Pichler (66:46.00)
Aronson (65:0.50)
U.S. DOL (65:20.60)

Another method by which workers may be encouraged to accept job transfers (intra-or inter-plant) and by which union resistance to change can be lowered is for labor and management to agree on the maximum number of paygrades a worker may be lowered if he accepts transfer to a new work activity. Nelson, Peck, and Kalachek[138] advocated the use of a limit on paygrade decreases as a method of aiding older worker adjustment. The U.S. Dept. of Labor report[139] on the impact of new technology in a gas and electric utility pointed out that maintenance of pay with job transfer eliminated a major source of employee anxiety.

The second half of this section contains material concerning retraining efforts in the private sector as a means of aiding worker adjustment to technological change. The use of retraining within the firm appears to be extremely widespread, more so probably than any other form of adjustment mechanisms discussed in the literature. Retraining occurs in formal programs and, evidently, to a greater extent through informal on-the-job activities. Retraining is often used in conjunction with job transfers since new skills are often required for a new work activity.

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[136] Weber (63:18.00)

[137] Davey (72:4.00)

[138] Nelson, Peck and Kalachek (67:14.00)

[139] U.S. Dept. of Labor (65:20.60)

The amount of literature giving evidence of private retraining and/or advocating private retraining as a method to cushion substantially the impact of technological change on workers is extensive from the early 1960's through the early 1970's.[140] Several areas of disagreement or differing views concerning the use of retraining do exist in the literature and these will also be discussed.

To begin the discussion of specific material, two articles that conclude there has been relatively little impact on needed skills from automation, discuss the proper role for retraining to aid the small number of workers who are affected. Aronson[141] found that for displaced low-skill workers, retraining was the best solution; however, he found that only the highly skilled jobs need extensive retraining. Herman[142] in a study of twelve plants that had implemented computer control systems, concluded there was little impact on most skills including lower skill levels. Some higher-skill-level jobs were created, and workers retrained for these positions enjoyed higher wages.

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[140] In addition to the articles to be discussed individually, see:

B.L.S., DOL (72:2.00)
Davey (72:4.00)
Robinson (71:7.25)
Stern (71:9.00)
Kassalow (70:8.00)
Killingsworth (70:9.00)
McNiff (70:9.50)
Meshel (70:11.70)
Weinberg (70:17.85)
Wolfbein (70:19.00)
Levine (69:14.00)
Ullman (69:33.00)
Burack and McNichols (68:0.50)
Freedman (68:4.50)
Manpower Adm., DOL (68:10.00)
Takahashi (68:19.00)
Weber (68:20.00)
Barkin (67:2.50)
Canada, Dept. of Labour (67:7.50)
Kelber and Schlesinger (67:11.00)
Nelson, Peck and Kalachek (67:14.00)
Weinberg and Ball (67:23.00)
OECD (66:0.50)
Kheel (66:32.00)
National Commission (66:41.00)

[141] Aronson (65:0.50)

[142] Herman (70:6.00)

Piore,[143] in a study based on extensive interviews in eleven industries, found informal on-the-job training to take place as technological change occurs, during the process of innovation, installation, and debugging of the new equipment; training, innovation, and production then should be viewed as joint products. He also concluded that informal on-the-job training appears to be a much more important source of skills than are schools, apprenticeship, the armed forces, or company classroom-training for almost all blue-collar manufacturing occupations. Similarly, the Mueller, et al[144] study concluded that specific, on-the-job training seems to prepare workers better for new jobs than general vocational education does.

Pichler reported in two articles[145] on the use and effect of retraining for workers displaced by plant shutdowns. He found that acceptance of retraining showed a negative relation with age and educational achievement. Unskilled workers and those with skills not transferable across industry lines were more likely to use retraining programs. In attempting to measure the impact of retraining, he found various results according to the criteria used. Retraining lowered the unemployment rates only if high labor demand was present after retraining was finished. Post shutdown earnings did not appear to be affected immediately by training; however, trainees did enjoy greater upward-skill mobility than did nontrainees, so their long run wage prospects may have been enhanced.

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[143] Piore (66:14.00)

[144] Mueller, et al (69:23.00)

[145] Pichler (66:46.00 & 67:18.00)

Several studies for specific industries have shown the value of retraining for both on-the-job training and special programs. Goldberg[146] discusses the wide use of training programs to upgrade skills in longshoremen, in order to allow them to handle the new equipment. Prasow and Massarik[147] concluded that in the aerospace industries unskilled people can be hired at low levels to be trained via on-the-job methods to work with new equipment. A study[148] of an electric and gas utility found that training was a key measure in facilitating the successful adjustment of employees assigned to new work. Training was almost always provided on-the-job, during working hours. Critchlow,[149] in a study of the U.S. printing industry, and an Australian Dept. of Labour and National Service study[150] of the printing trades found that rather extensive retraining had allowed for smooth adjustment to technological change by most affected workers. Vickery,[151] in a study of "New Technology in Laundry and Cleaning Services," recommends that unions and management implement training programs to augment some existing retraining for foremen, maintenance men, and administrators.

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[146] Goldberg (71:3.50)

[147] Prasow and Massarik (69:27.00)

[148] U.S. DOL (65:20.60)

[149] Critchlow (70:3.00)

[150] Australia Dept. of Labour (69:0.75)

[151] Vickery (72:21.00)

A number of studies have recommended the use of expanded use of retraining programs to aid worker adjustment to new technology.[152] Berenschot[153] argues that specialized training on the job should be coordinated with public education and pre-vocational training. He feels that capable employees should be given opportunities for training in stages throughout their working careers and that a career would then become a dynamic process of retraining. Bolz[154] argues that it is management's responsibility to persuade workers to undertake retraining so that technological change can be to their advantage. Critchlow[155] and Warner[156] have advocated expanded union sponsorship of retraining programs for members.

Several writers urge greater retraining opportunities in the private sector for special worker groups. Agassi[157] stresses that the private sector must provide greater labor mobility and opportunities to women by giving them more technical training. Two studies recommend the

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[152] For example, see:

Mortimer (71:4.90)	Warner (65:21.00)
Howenstine (72:8.00)	Calif. Commission (64:6.00)

[153] Berenschot (67:3.00)

[154] Bolz (66:6.00)

[155] Critchlow (70:3.00)

[156] Warner (65:21.00)

[157] Agassi (70:3.00)

expanded use of training opportunities to aid older workers. Dunlop[158] speaks for older workers in general, while Dalton and Thompson[159] argue for innovations in retraining methods to aid older engineers whose skills have been made obsolete.

Various warnings concerning the use of retraining also exist. An O.E.C.D. study[160] and a study by the Manpower Administration fo the U.S. Dept. of Labor[161] counsel against too narrow skill or job training which may be outmoded as soon as it is completed. The manpower administration study also points out that when technologies are altered a great deal, the potential for successful, comprehensive on-the-job training is diminished. Padfield and Martin, [162] in their study of farm workers and mechanization, discuss various ways in which retraining could be used; but they warn that, on the whole, rehabilitating Anglo-isolates (Native Americans and Mexican Americans) by retraining is not possible. This would be proposing vocational solutions for social and emotional problems. Finally, Bright's[163] warning against too much skill-upgrading in public programs can be repeated for private sector programs. Bright believes that automation will not significantly increase required skill levels for workers, except, perhaps, for some persons in the maintenance areas.

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[158] Dunlop (66:20.00)

[159] Dalton and Thompson (71:2.00)

[160] OECD (66:45.00)

[161] Manpower Adm. DOL (68:9.00)

[162] Padfield and Martin (65:13.00)

[163] Bright (66:9.00)

2. Job Protection Techniques

When the introduction of new technology threatens to reduce employment levels, various methods of protecting the jobs of all or part of the present workers have been established by management and by union-management cooperation and/or negotiation. One very commonly used means of maintaining the jobs of the existing work force has been to let normal attrition (quits, retirements, deaths) reduce the work force to the new, lower required level. This is another apparently widely used adjustment mechanism that has received little attention in the more popularized literature but is discussed in a great many professional articles.[164]

A few specific examples can help point out the widespread use of attrition. Walker[165] reports on the use of attrition plans for non-manual workers threatened by technological change in Western Europe, the United States, Canada, Japan and Australia. Gomberg[166] reports on the use of normal attrition as an adjustment mechanism for longshoremen, for railroad workers, and for steel industy workers. Robinson[167] found that most firms allowed normal labor turnover to absorb any impact of automation on clerical jobs. Freedman[168] reports the use of attrition to aid the adjustment of telephone operators as the industry automated. A Business Week article[169] reported on the use of attrition to aid worker adjustment at a newspaper printing plant.

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[164] In addition to the articles discussed individually, see:

Davey (72:4.00)
Rehmus (71:6.50)
Delamotte (71:3.00)
Critchlow (70:3.00)
Horrigan (70:6.50)
Shils (70:15.00)
Weinberg (70:17.85)
Rothberg (69:29.00)
Takahashi (68:19.00)
Weber (68:20.00)
Barkin (67:2.50)
MacDonald (67:12.50)
Nelson, Peck, and Kalachek (67:14.00)

[165] Walker (67:22.50)

[166] Gomberg (65:6.30)

Attrition may lead to problems, as pointed out in the Business Week article discussed above where a union charged the firm with attempting to increase work loads through the attrition scheme by releasing more employees than they should have. Wolfbein[170] and Kheel[171] point out that attrition due to automation is a threat to the labor force because it creates no new jobs. Kheel also points out that attrition hurts organized labor by reducing the number of workers involved.

The use of seniority as a basis for retention during periods of decreasing employment is a standard practice in much of the business and industrial world. Widening and broadening the seniority base appears to be fairly commonly used and advocated method of maintaining the employment of older, more established workers when firms implement new technology which displaces workers.[172] This involves spreading the workers' seniority to include workers in all sections fo the plant or perhaps in all plants owned by the firm. Barbash[173] and Killingsworth[174] both point out the growth in union pressures for broader seniority units as workers' fear of displacement by technological change increases. Herding,[175] in a study primarily of automobile and steel industries in the U.S. and West Germany, found that attempts to gain effective seniority and other job protection clauses in bargaining have often failed, largely because the international federation of the unions involved are more concerned with wages, fringe benefits and earnings stabilization.

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[167] Robinson (71:7.25)

[168] Freedman (68:4.50)

[169] Business Week (73:0.25)

[170] Wolfbein (70:19.00)

[171] Kheel (66:32.00)

Davey[176] argues that workers forced to transfer to another plant in order to retain employment should have their seniority protected. Weber,[177] in his study concludes that the disposition of seniority rights is an important factor in determining the effectiveness of inter-plant transfer systems. On the other hand, arguments against broader seniority have been raised by some. Porchkis[178] believes that seniority clauses protect white workers while they displace non-whites who do not get to build up seniority sufficient to protect them. Younger workers, in general, may object to broader seniority systems, because such systems allow older workers to take jobs even if the jobs are in other plants or sections than where the older workers are presently located.

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[172] In addition to the articles cited individually, see:
Golodner (73:1.00)
King (72:12.00)
Rehmus (71:6.50)
McNiff (70:9.50)
Shils (70:15.00)
Mueller et al (69:23.00)
Prasow and Massarik (69:26.00)
Freedman (68:4.50)
Goldberg (68:5.00)
Zeisel (68:21.00)
Barkin (67:2.50)
Canada Dept. of Labour (67:7.00)
MacDonald (67:12.50)

[173] Barbash (63:1.00)

[174] Killingsworth (70:9.00)

[175] Herding (72:6.50)

[176] Davey (72:4.00)

[177] Weber (63:18.00)

In specific industry studies, Killingsworth[179] discusses the use and negotiation for broader seniority units among workers in the automobile, rubber, steel, and railroad industries and among longshoremen. More recently, Levine[180] also discussed seniority systems for railroad workers while Goldberg[181] discussed seniority use among longshoremen.

Transfer based on seniority and ability of displaced workers in a gas and electric utility was discussed in a U.S. Dept. of Labor report.[182] Finally, Nelson, Peck and Kalachek[183] argued for the widest possible seniority base in order to aid older workers displaced by technological change, since these workers encountered the greatest re-employment problems.

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[178] Porchkis (66:47.00)

[179] Killingsworth (63:9.00)

[180] Levine (69:14.00)

[181] Goldberg (71:3.50)

[182] U.S. DOL (65:20.60)

[183] Nelson, Peck and Kalachek (67:14.00)

One of the most controversial and emotional adjustment mechanisms discussed in the popular and professional literature is job protection through various types of job security provisions involving work rules, job task assignments, "featherbedding," job flexibility, guaranteed employment, etc.[184] Basic to many of the job security discussions is the concept of the worker's property right to his job (as discussed in Part I of this report). Gomberg[185] has developed the logic behind the worker's property right to his job; and he argues that this right must be accepted by management and the public in bargaining agreements. He does point out that unions also have the responsibility not to take an anti-technology position; so he associates job security with a growing, vigorous national economy.

As Killingsworth[186] points out, one of the results of automation appears to be an increased emphasis on job security in collective bargaining, including attempts at "job freezes" and at more restrictive work rules. Several labor disputes such as the highly publicized ones in the construction industry[187] in the steel industry and in the railroad industry[188] have occurred over the issues of job security and work rules. Strong work-rule and work-preservation clauses do exist or have existed in some areas such as the printing and publishing trades,[189] Kasier Steel,[190] railroads,[191] and among longshoremen.[192]

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[184] In addition to the articles cited individually, see:
Davey (72:4.00)
B.L.S., DOL (72:2.00)
Jenson (71:4.00)
Kassalow (70:8.00)
Moore (70:12.00)
Weinberg (70:17.85)
Mueller et al (69:23.00)
Mann and Williams (68:8.00)
Kelberg and Schlesinger (67:11.00)
MacDonald (67:12.50)
N.A.M. (67:13.75)

[185] Gomberg (65:6.30)

[186] Killingsworth (70:9.00)

The general impression from the literature is that the number of restrictive work rules in practice in the United States is small and somewhat isolated to certain organized fields. The effects on the U.S. economy appear to be slight, at most. Certainly the effects in the U.S. cannot be compared to those in Great Britain, where a common contention has been that British trade unions' restrictive practices have been partially responsible for the poor economic performance of that nation. Mortimer[193] argues that the unions even in Britain have adopted more productive approaches. Kheel[194] believes that while organized labor has, at times, responded to automation with featherbedding techniques, this is not the usual approach, because society resents this technique and because many unions promote automation to reduce drudgery and increase incomes. Thus he concludes that unions usually seek other forms of adjustment mechanisms. Herding[195] feels that unions have not been successful in job control because of lack of support at the international union level. King,[196] in a study of arbitration cases, concludes that unions have been quite aggressive in attempting to counter the move to advanced technological methods; but they have been successful in only 22 percent of the cases. The unions, however, have rarely violated "no-strike" clauses in their disputes. Arbitrators have been firm on the retention of present workers covered in existing contracts clauses on work arrangements.

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[187] Smith (72:19.00)

[188] Killingsworth (63:9.00)

[189] Critchlow (70:3.00)

[190] David (64:8.50)

[191] David (64:8.50)

[192] Killingsworth (63:9.00), Goldberg (71:3.50)

[193] Mortimer (71:4.90)

[194] Kheel (66:32.00)

In specific organized labor contracts, little evidence of the existence of disruptive work rules or even the extensive existence of restrictive work rules is found in the literature. Rehmus[197] concludes that the railroads' disputes with the railroad brotherhoods have not in any significant way impeded the introduction of changed and improved technology nor have the disputes impeded the general dispersion of the resulting gains from improved technology. Killingsworth[198] found few work rules in existence in the rubber industry and in the auto industry outside of those rules of the skilled trades groups. Hartman,[199] Goldberg[200] and Killingsworth[201] point out the switch from very restrictive work rules to much more flexible job assignments that was accepted in 1960 by the longshoremen. Hartman concludes there was a very substantial annual savings to the industry as a result of the elimination of the restrictive work practices, and he expresses the opinion that the union members were better off with better wages and easier physical work. Godberg points out that the regular longshoremen labor forces have been kept in balance by upgrading to senior, regular positions only as needed, and by limited entry to less senior categories. A U.S. Dept. of Labor study[202] points out that restrictive practices can often be justified on the basis of safety and must be considered in relation to the particular industry in which they are established.

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[195] Herding (72:6.50)

[196] King (72:12.00)

[197] Rehmus (71:6.50)

[198] Killingsworth (63:9.00)

Weinstein[203] discusses how management must anticipate the cost of potential labor resistance to technological change and include this cost in calculating the expected rate of return from the investment. If the investment will not pay because of labor resistance, Weinstein points out that firms may choose to implement the new technology in such a way as completely to eliminate the troublesome worker group and union. As an example of this, Killingsworth[204] points out that the rubber industry when faced with wildcat strikes and organized shutdowns by labor countered, in the late 1950's, by building completely new modernized plants and letting old plants suffer.

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[199] Hartman (69:10.00)

[200] Goldberg (71:3.50)

[201] Killingsworth (63:9.00)

[202] U.S. DOL (69:35.00)

[203] Weinstein (65:21.60)

Several authors have pointed out that management can reduce the employment impact of technological change by not overstating the skill-level requirements for jobs and by making better matches between workers' skills and existing work needs. Bright[205] pointed out the danger of over-skill specification in industry in general as industry automates. Burack and McNichols[206] and Dalton and Thompson[207] have discussed the idea that the better coordination of available skills and job assignments can lessen the impact of technological change on older managerial personnel and on older engineers.

Several articles[208] discussed the ways in which management could affect the employment impact of technological change by the timing and/or type of innovation introduced. Studies such as the one on the Atlanta Office of the IRS have shown that a slow, gradual introduction of new innovations to be much less disruptive on employment than is rapid conversion. If a choice in the form or type of innovation is available, then it may be possible to choose a type that better fits present employee skills. Herman[209] found little labor displacement had occurred in twelve plants in various industries as computer-controlled systems were installed gradually over time, Prasow and Massarik[210] and Welsh,[211] in their studies of the aerospace industry and the retail food industry, respectively, found that gradual introduction of change allowed for smooth adjustment. Welsh, in the study mentioned above, and Barkin[212] emphasize the need for planning for the innovation and for communication among management, union and labor concerning the projected change.

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[204] Killingsworth (63:9.00)

[205] Bright (66:9.00)

[206] Burack and McNichols (68:0.50)

[207] Dalton and Thompson (71:2.00)

[208] See, for instance, the following plus those cited individually:
Women's Bureau, DOL (70:19.50)
Hartman (69:10.00)
Mueller *et al* (69:23.00)
Prasow and Massarik (69:26.00)
Crispo (68:1.00)
Kelber and Schlesinger (67:11.00)
N.A.M. (67:13.75)
Weinberg and Ball (67:23.00)

The information of multicraft unions or union mergers is another technique to enhance labor's power to promote job protection and other adjustment mechanisms; this technique has been reported on or advocated in several articles. One reason for the wider union base is to overcome problems in union jurisdictional lines and functions created by new technologies when these problems tend to blur old craft and job distinctions.[213] Weinstein[214] points out another reason for multicraft unions. If companies attempt to eliminate one skill or craft line by the technological change and thus eliminate that union group, the use of multicraft or union merger will counter this movement. This would allow for a broader seniority base and a common bargaining group. In a similar manner, Kheel[215] and Weber[216] argued that technological change was causing a decline in the relative size and strength of unions and that a broader union base would aid unions in restoring their bargaining powers. Weinstein, however, points out that as of the mid-1960's, no significant move towards the use of multicraft unions or union mergers had appeared.

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[209] Herman (70:6.00)

[210] Prasow and Massarik (69:27.00)

[211] Welsh (65:22.00)

[212] Barkin (67:2.50)

The use of white collar unions to aid worker adjustment to technological change is discussed and reported on by several writers.[217] This gives white-collar workers an organized base from which to bargain and a means to promote their own job security. It may also aid blue collar workers by giving a larger and broader base of workers represented in the bargaining process much as a multicraft union would.

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[213] See, as examples:
Meshel (70:11.70)
Warner (65:21.00)
Critchlow (70:3.00)

[214] Weinstein (65:21.60)

[215] Kheel (66:32.00)

[216] Weber (66:63.00)

[217] See, for instance:
Weber (66:63.00)
Kheel (66:32.00)
Mann and Williams (68:8.00)
Shils (70:15.00)
Golodner (73:1.00)

3. Work Sharing Arrangements

The industrialization process in western economies, in Japan and in Australia was accompanied by reduced hours of work per day and per week and more vacation time and holidays. Thus with the "automation revolution" of the late 1950's and early 1960's, many writers speculated that the technological change would lead to further decreases in working hours. Other writers thought that work sharing arrangements would be necessary to keep unemployment from increasing as a result of automated processes. While some evidence of work sharing and shorter working hours is found, this appears to be occurring in a few rather isolated areas; it is not clear that the shorter working hours are always the result, either wholly or partially, of technological change.

Two other methods of sharing the work that have been discussed at various lengths are reduction of overtime and extended vacations. Aronson,[218] in his study of the general economy, found that reduction of overtime was seldom used as an adjustment to technological change. Kheel,[219] in his study of the 25-hour work week for New York City electricians, found the shorter work week had not caused much overtime (and had caused fewer new jobs to develop than was expected). Several articles[220] have discussed the use of extended vacations and have reported discussions of it in collective bargaining procedures; however, outside of a few headline-gathering settlements such as the steelworkers' contract, few references are found to the use of extended vacations, especially as an adjustment to technological change. The use of early retirement plans can be viewed as a means of increasing employment for younger workers. (These systems will be discussed in the next section under Income Securities.)

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[218] Aronson (65:0.50)

[219] Kheel (64:16.00)

As pointed out above, a large number of speculative discussions of the use of work sharing and shorter work weeks as adjustment mechanisms for technological change exist in the literature. Dates of publication of these more speculative discussions are clustered in the early and mid 1960's up through 1966,[221] and they appear again in the early 1970's.[222] It is tempting to speculate on the effect of the recession of 1958-1962 on the appearance of the later articles, and of the strong economic growth of the latter 1960's on the lack of work sharing discussions for that period. Examples of these speculative discussions include Siemiller's[223] statement that collective bargaining can reduce the impact of automation by seeking, among other things, a shorter work week, and Kheel's[224] discussion of unions reacting by seeking, in many cases, a shorter work week. Dunlop[225] argues for shorter hours and job sharing to aid the adjustment of older workers, while Baker[226] points out that part time work will enable men and women to lead private lives as well as careers.

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[220] Weber (68:20.00)
Froomkin (66:23.00)
Sheppard (66:55.00)
Siemiller (70:17.20)

[221] See,
Faunce (62:1.00)
Calif. Commission (64:6.00)
Weber (66:63.00)
Sheppard (66:55.00)
National Commission (66:41.00)
Froomkin (66:23.00)
Allen (66:1.00)

[222] See,
Women's Bureau, DOL (70:19.50)
McNiff (70:9.50)
Reisman (71:7.00)
Jensen (71:4.00)
Delamotte (71:3.00)

Work sharing provisions have been encountered and discussed in the literature. Stieber,[227] in a 1961 article, discusses the use of work sharing in several manufacturing industries during the late 1950's; and Weber,[228] in a 1968 article, discusses work sharing as one means to lessen worker displacement that is found in labor-management agreements. Kheel[229] discusses the 25 hour work week for New York City electricians. Walker[230] found some work sharing in reaction to automation in banks and insurance firms in the U.S. and other developed economies; and Killingsworth[231] reports on the union acceptance of work sharing in the rubber industry. Considerable evidence in the literature points to the lack of use of work sharing agreements in the vast majority of businesses as a means to adjust to technological change. Mueller, et al,[232] in their survey of workers in a cross-section of U.S. industries, found only a small percentage had worked shorter hours because of changing technology. Aronson,[233] in his study of industries and firms in the U.S., found that the reduction of work hours was seldom used. In Canada, a study of 471 contract agreements[234] found that provisions for work sharing were seldom used in response to problems relating to new technologies.

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[223] Siemiller (70:17.20)

[224] Kheel (66:32.00)

[225] Dunlop (66:20.00)

[226] Baker (64:2.00)

[227] Stieber (61:1.00)

[228] Weber (68:20.00)

[229] Kheel (64:16.00)

[230] Walker (67:22.50)

4. Income Security Measures

This section will present a review of evidence and discussions concerning the use of income security programs as adjustment mechanisms for technology change. The measures which include early retirement, guaranteed annual wages (GAW), supplemental unemployment benefits (SUB), severance pay, profit sharing and other pay incentive approaches have received a large amount of publicity and have generated a considerable amount of controversy,

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[231] Killingsworth (63:9.00)

[232] Mueller et al (69:23.00)

[233] Aronson (65:0.50)

[234] Canada, Dept of Labour (67:7.50)

as have the various "restrictive" work rules approach to job security. Income security provisions are controversial because they extend employer-employee relations beyond the traditional wage payment for labor-services-rendered concept to a broader basis. The employee is given a share of the gains from technological change; that is, he is compensated for being displaced from work by forces beyond his control or, in the case of profit sharing or pay incentives, he is compensated for accepting change which alters the work activity and may threaten eventual displacement. As explained in Part I, the rationale for this is that society as a whole gains from technological improvements; thus labor demands income securities to make sure the cost of the improvement is not imposed on one small segment of society.

Concerning the use of income security measures as adjustment mechanisms, the general impression from the literature is that they are used far less than retraining, transfer, attrition and wider seniority are used but far more than work sharing and restrictive work rule arrangements are used. This would be true for probably all the income security approaches except the guaranteed-annual-wage system, where the publicity seems to far outweigh the use.

The first income security to be covered is early retirement programs, since this is one form of generating greater attrition and sharing the work with younger workers. Related issues with early retirement are the pension and fringe benefit rights and amounts. A great many articles have cited the use of early retirement plans and/or advocated their expanded use.[235] A relatively large amount of the material was published in the latter 1960's and early 1970's; thus early retirement plans, or at least, interest in them was not dulled by the long full employment growth period of the middle and late 1960's.

Stieber,[236] Weber[237] and Kassalow[238] all point to the broad use and expansion of early retirement plans in labor contracts in a great variety of industries. Killingsworth[239] points out the development of early retirement programs in the auto industry, in the steel industry and for longshoremen. Ullman[240] discusses the early retirement provision as an aid to older worker adjustment to a plant shutdown. Critchlow[241] discusses the development of early retirement provision in the printing and publishing industries. Faltenmayer[242] agreed that the provision for early retirement was becoming wider and wider spread; but, at least in the mid-1960's, it was not being used by a great many workers. Most older workers eligible for early retirement chose to stay on the job.

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[235] In addition to the articles referred to individually, see:
Davey (72:4.00)
Goldberg (71:3.50)
Horrigan (70:6.50)
Women's Bureau, DOL (70:19.50)
Perline and Tull (69:25.00)
Freedman (68:4.50)
Kheel (66:32.00)
Weber (66:63.00)
Calif. Commission (64:6.00)

[236] Stieber (61:1.00)

[237] Weber (68:20.00)

[238] Kassalow (70:8.00)

[239] Killingsworth (63:9.00)

[240] Ullman (69:33.00)

[241] Critchlow (70:3.00)

[242] Faltenmayer (65:5.70)

Two studies do report on the use of early retirement in specific areas. A U.S. Department of Labor study[243] concludes that due to workers' retirement, job openings in railroads remained, even with declining employment. Owen and Belzung[244] discuss the use of early retirement at a specific petroleum refinery. They found that many workers would choose early retirement if the income were great enough. Those who had retired from the refinery seemed to be enjoying it, had excellent mental health, and good family relations; and many had sought other part-time or full-time work.

Several articles discuss the need for early retirement and some of the issues early retirement generates.[245] Siemiller[246] believes that the impact of automation on jobs will continue to increase and that measures such as early retirement will become more and more necessary. An international colloquium[247] concluded that automation was making it increasingly more difficult for older workers to adjust to changing employment requirements;

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[243] U.S., DOL (72:2.00)

[244] Owen and Belzung (67:16.00)

[245] For example, see:
Gerber (65:6.30) Dunlop (66:20.00)

[246] Siemiller (70:17.20)

[247] International Colloquium (70:0.10)

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and the colloquium suggested that early retirement would be one viable alternative. Odell[248] concludes that if early retirement is to be encouraged then a great many programs for the retired must be developed so that retirement can give a life of dignity and security .

As mentioned above, the pension amount and rights are very important in the decision to use early retirement; so is the availability of other fringe benefits such as health insurance. The effect that accepting early retirement has on social security payments and "normal" pension payments when the regular retirement age is reached is important. These issues are discussed in many reports and studies.[249]

In addition to the relation of pension plans to early retirement, the disposition of pension rights can affect labor adjustment by influencing workers' acceptance of job changes. Dunlop,[250] Segal[251] and Warner[252] all point to the need for vesting the pension rights with the workers when he transfers jobs. In this way the older worker does not lose pension payments if he is forced to change jobs; and, one could hope that he would be more receptive to employment changes. Aronson[253] concluded that the vesting of pension rights increased attrition while providing better security for older workers. Agassi[254] argues that women must have equal access to all job protection and security measures, including pension rights; women need these protections in order to allow them to have equal access to and incentive for seeking new jobs being created by technological change.[255]

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[248] Odell (65:11.50)

[249] For example, see:

B.L.S., DOL (72:2.00)
McNiff (70:9.50)
Levine (69:14.00)
Goldberg (68:5.00)
Barkin (67:2.50)
Canada, Dept. of Labour (67:7.00)
OECD (66:0.50)
Bolz (66:6.00)
B.L.S.. DOL (66:12.00)
Froomkin (66:23.00)

[250] Dunlop (66:20.00)

[251] Segal (64:30.00)

[252] Warner (65:21.00)

When automation displaces workers and early retirement is not a feasible solution, some form of income maintenance over the short run or long run is often proposed and used. This income maintenance may be a guaranteed-annual-wage or income, if the unemployed workers' skills are viewed as generally redundant in the economy (and the union is in a strong bargaining position), or it may be supplemental unemployment benefits (SUB) or severance pay received due to technological displacement The SUB or severance pay is meant to be a compensation to allow workers to maintain expenditures and lifestyles while finding re-employment.

The guaranteed annual wage and the supplemental unemployment benefits programs have received wide coverage and have been a source

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[253] Aronson (65:0.50)

[254] Agassi (72:1.50)

[255] For other references to pensions and technological change, see:

Golodner (73:1.00)	Stern (69:31.00)
Jensen (71:4.00)	Crispo (68:1.00)
Shils (70:15.00)	Kelber and Schlesinger (67:11.00)
Hartman (69:10.00)	Pichler (66:46.00)

of conflict, as the actual need or rationale for these types of payments is debated, and the effects these compensations have on people's willingness to accept employment and to be mobile in the labor market is analysed. The use of severance pay appears to be much more widespread and to have a much longer tradition than either of the other more glamorous income compensations for displacement.[256]

Taft[257] discusses the development of several dismissal compensation plans in the 1920's and 1930's; and he argues that the use of severance pay helps ease the burden for the displaced worker who is not a risk taker in our system and who is to be treated as a cost-of-business, including investment in new technologies. Aronson,[258] Kheel,[259] and an OECD study[260] all report on the use of severence pay in the economy as a means of aiding displaced workers. Weber[261] also reports on the use of severance pay, which is one of the mechanisms he groups under the "buy-out" approach to aiding adjustment. He states that management gains from the "buy-out" technique, since with this approach its moral responsibility to workers is translated into financial terms; and then management has almost a free hand in increasing efficiency. A U.S. Department of Labor report[262] discusses the use of severance pay in railroads and airlines; Levine[263] discusses its use in railroads; and Killingsworth[264] discusses its use in the rubber industry.

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[256] In addition to the articles discussed individually, see:

Golodner (73:1.00)
Davey (72:4.00)
Horrigan (70:6.50)
Siemiller (70:17.20)
Herding (72:6.50)
Delamotte (71:3.00)
Stern (71:9.00)
Lipsky (70:9.40)
Moore (70:12.00)
Stern (69:31.00)
Takahashi (68:19.00)
Barkin (67:2.50)
Canada, Dept. of Labour (67:7.00)
Canada, Dept. of Labour (67:7.50)
NAM (67:13.75)
National Commission (66:41.00)
B.L.S., DOL (66:12.00)
Pichler (66:46.00)
Weber (66:63.00)
Freedman (68:4.50)

[257] Taft (63:16.00)

[258] Aronson (65:0.50)

[259] Kheel (66:32.00)

[260] OECD (66:0.50)

[261] Weber (68:20.00)

Pichler,[265] in his case study, found that those workers who received a large severance payment showed some tendency to accept re-employment later than those with a lesser payment. King,[266] in his study of arbitration cases over the 1960's, found that arbitrators held that severance pay should be paid only if workers moved completely out of a plant and not if they transferred jobs within a plant. Nelson, Peck and Kalachek[267] stress the need for severance pay compensation for displaced older workers who face particularly difficult problems in finding re-employment.

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[262] DOL (64:8.50)

[263] Levine (69:14.00)

[264] Killingsworth (63:9.00)

[265] Pichler (67:18.00)

[266] King (72:12.00)

[267] Nelson, Peck and Kalachek (67:14.00)

Many articles have discussed the use and issues surrounding the use of supplementary unemployment benefits (SUB).[268] The impression from the literature is that the use of SUB is less frequent than the use of severance pay (although greater than guaranteed annual wages), but that use of SUB plans has increased substantially over the last ten to fifteen years, especially in the well organized industries.[269] Several studies discussing the use of SUB plans in specific industries are found in the literature. These include studies on the railroads,[270] longshoremen,[271] and on the automobile, steel and rubber industries.[272]

Gomberg[273] argues that the establishment of SUB, early retirement and normal attrition plans maintain worker security while allowing management to pursue efficient production methods; thus they help to maintain strong growth in our economy. Barbash[274] concludes however that unions demand SUB plans only after attempts at blocking change and maintaining jobs have failed. All the references to the use and establishment of SUB plans were for industries where labor was organized, in fact, well organized. Schmitz and Seckler[275] conclude in their study of the mechanization of tomato harvesting that the displaced workers could have been compensated for wage loss, and the net social returns from mechanization would still have been highly favorable. Because tomato pickers were unorganized, no compensation was demanded or paid.

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[268] Goldberg (71:3.50)
Stern (71:9100)
Critchlow (70:3.00)
Killingsworth (70:9.00)
McNiff (70:9.50)
Canada, Dept of Labour (69:2.00)
Perline and Tull (69:25.00)
Canada, Dept. of Labour (67:7.00)
MacDonald (67:12.50)
Bolz (66:6.00)
OECD (66:0.50)
B.L.S., DOL (66:12.00)
National Commission (66:41.00)
Weber (66:63.00)
Weber (63:18.00)

[269] For duscussions of SUB use in the economy, see:
Weber (68:20.00)
Kheel (66:32.00)
Aronson (65:0.50)
Stieber (61:10.00)

[270] B.L.S., DOL (72:2.00)
Levine (69:14.00)
David (64:8.50)

[271] Hartman (69:10.00)

[272] Killingsworth (63:9.00)

[273] Gomberg (65:6.30)

The use and misuse of a guaranteed annual wage (GAW) as an adjustment mechanism is an often discussed topic.[276] The GAW proposals are very controversial because they require employers to pay wages to a minimum number of employees, whether the employees are needed or not by the firm regardless of whether or not the displaced worker can find re-employment elsewhere. As mentioned earlier, the actual use of GAW systems appears to be very restricted, and the literature covering its use tends to limit its discussion to the GAW plans in the steel industry[277] and for longshoremen.[278] Ross,[279] in a study of 471 labor agreements in Canada for firms with 500 or more employees, found that the most used method of compensation for the effects of technological change was some form of income maintenance.

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[274] Barbash (63:1.00)

[275] Schmitz and Seckler (70:13.40)

[276] Delamotte (71:3.00)
Jensen (71:4.00)
Rehmus (71:6.50)
Stern (71:9.00)
Goldberg (68:5.00)
Weber (68:20.00)
Perline and Tull (69:25.00)
Barkin (67:2.50)
MacDonald (67:12.50)
OECD (66:6.50)
Bolz (66:6.00)
National Commission (66:41.00)
Weber (66:63.00)
Calif. Commission (64:6.00)
Stieber (61:1.00)

Profit sharing and pay incentive programs are methods by which management compensates workers in order to get their cooperation in implementing new technologies. Obviously those workers who are not displaced by technological change gain the most from these systems, since the displaced worker gets only the compensation received, if any, while he was employed. Weber[280] points out that two of the best known applications of this method are those of the United Mine Workers and the Kaiser Steel Plan.

The Mueller et al study[281] pointed out that workers are willing to accept technological change because this raises the chance of increased wages for most groups. Walker[282] found that automation of clerical work has led to some extension of work shifts but that this extension was compensated for by extra income. Burock and McNichols[283] advocate the use of salary incentives to older supervisors and younger technicians in order to promote personal development and thus better accomodate technological change in the firm.

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[277] Killingsworth (63:9.00), David (64:8.50)

[278] Goldberg (71:3.50 & 63:9.00)

[279] Ross (68:15.90)

[280] Weber (68:20.00)

[281] Mueller et al (69:23.00)

[282] Walker (67:22.50)

[283] Burock and McNichols (68:0.50)

5. Re-employment Aids

One method of aiding the search for re-employment for workers displaced by technological change is to give the threatened employees an advance notification several weeks or months before the actual layoff is to occur, so that they may consider transfer, retraining and/or start to seek re-employment. Many references can be found which discuss the use of advance layoff notification and termination procedures to aid displaced workers.[284] Killingsworth[285] points out the development of advance-layoff provisions in collective bargaining as a result of automation.

Usually the advance layoff notification is linked to a general advance notification of a coming technological change and to planning for that change. Ullman[286] and Stern,[287] in studies of plant shutdowns, both conclude that advance notification with an adequate lead time can allow planning to take place that will aid the adjustment of workers who must be terminated. A major feature of the adjustment process for telephone operators was the planning, well in advance, for the estimated number of operators who would be needed after the technological change and the advance layoff notification given those who had to be displaced.[288]

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[284] For example, see;
Rehmus (71:6.50)
Horrigan (70:6.50)
Lipsky (70:9.40)
Shils (70:15.00)
Canada, Dept of Labour (69:2.00)
Zeisel (68:21.00)
Canada, Dept. of Labour (67:7.00)
Canada, Dept. of Labour (67:7.50)
Bolz (66:6.00)
Kheel (66:32.00)
National Commission (66:41.00)
Aronson (65:0.50)
Goodwin (65:6.50)
Calif. Commission (64:6.00)

[285] Killingsworth (70:9.00)

[286] Ullman (69:33.00)

[287] Stern (69:31.00)

The necessity and value of advance notification of technological change for adequate planning and for labor-management cooperation has been repeatedly stressed in the literature over the last decade.[289] Barkin,[290] in a report based on 29 case studies, in several countries emphasized that advance planning with complete, open communication between management and workers is essential for successful adjustment to technological change. Two studies [291] of the railroads concluded that the successful adjustment mechanisms used by that industry included advance notice of major changes. A study[292] of the successful conversion to new technology at a utility company pointed out that management provided advance notice of change to the union

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[288] Freedman (68:4.50)

[289] See, for instance:

Stern (71:9.00)	Prasow and Massarik (69:26.00)
McNiff (70:9.50)	Rothberg (69:29.00)
Weinberg (70:17.85)	Crispo (68:1.00)
Perline and Tull (69:25.00)	OECD (66:0.50)

[290] Barkin (67:2.50)

[291] B.L.S., DOL (72:2.00), Levine (69:14.00)

[292] DOL (65:20.60)

and employees as much as two years in advance of the actual changeover. Much of the planning was carried out jointly by management and the union and began from six months to two years ahead of the technological conversion.

In addition to the advance notification of layoffs, the soon-to-be-displaced worker can be aided by counseling, placement and referral services established before dismissal time by management and unions.[293] The National Commission on Technology, Automation and Economic Progress[294] and Rothberg[295] stressed the need for additional counseling and for placement activities in the firm to aid displaced workers. Dalton and Thompson[296] believe that part of the observed technological obsolescence of older engineers could be eliminated with better counseling services. Ullman[297] and Kheel[298] report on the development and use of counseling and placement services to aid displaced workers.

Little mention of preferential rehiring as an adjustment mechanism for technological change was found in the literature; however, preferential rehiring practices feature of collective bargaining agreements and of many

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[293] For example, see:

Prasow and Massarik (69:26.00)	Bowers (65:3.00)
N.A.M. (67:13.75)	Calif. Commission (64:6.00)

[294] National Commission (66:41.00)

[295] Rothberg (69:29.00)

[296] Dalton and Thompson (71:2.00)

[297] Ullman (69:33.00)

[298] Kheel (66:32.00)

managerial rehiring practices following layoffs; and workers displaced by technological change would be covered in these arrangements also. Finally, Porchkis,[299] who believes automation hits minorities, especially Blacks, relatively harder, argues for preferential hiring of minorities to offset this.

6. Bargaining Procedures

Some writers have discussed the use of third parties to be participants in the bargaining process in order to promote smoother and more effective transitions to technological change.[300] These third parties may be arbitrators, mediators or other "neutrals," such as the labor-management committee set up in the steel industry[301] or the public-labor-management committee set up for railroads.[302] Levinson[303] argues that the use of national bargaining levels in the trucking industry has allowed for rapid absorption of technological change into the industry; and he argues for the acceptance of national bargaining in all the transportation industries.[304]

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[299] Porchkis (66:47.00)

[300] Kassalow (70:8.00)
Shils (70:15.00)
Stieber (61:1.00)
Canada, Dept. of Labour (67:7.50)

[301] Killingsworth (63:9.00)

[302] Killingsworth (63:9.00), Rehmus (71:6.50)

[303] Levinson (71:4.75)

[304] Levinson (71:7.70)

Conclusion

A large number of studies have concluded that labor-management cooperation, especially when combined with advance notification of change and advanced planning, has worked well to establish a number of effective adjustment mechanisms. These adjustment mechanisms in the private sector are most effective when full employment growth is being maintained in the economy. Many writers have stressed that the use of a variety of adjustment mechanisms is best.[305] This gives displaced workers alternatives and reduces the chance of workers being left out or being forced into taking an unsatisfactory method of adjustment. Among the private adjustment mechanisms, the most used appear to be intraplant and interplant transfer, retraining (especially on-the-job), attrition and seniority. On the public side, the use of retraining, public employment, public job information systems and government involvement in labor-management negotiations have all been discussed to some extent. In addition, the large amount of literature pointing out the need for full employment has been reviewed.

The literature, to a large extent, concludes that the actual amount of technological displacement that is occurring is below what it could be, as a result of the use of largely private adjustment mechanisms. Views on just how much effect technological change has had and is having on employment and required skills is highly debated, however, as is the ability of unions to cope with the problem. Some authors feel unions are not performing well in establishing adjustment mechanisms, and these authors cite evidence attempting to support this position. This view of lack of union development of effective adjustment mechanisms is thought by some to be due to the decrease in union power resulting from technological change; others feel it results more from lack of union concern for displaced workers.

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[305] For example, see:

B.L.S. DOL (72:2.00)
Weinberg (70:17.85)
Levine (69:14.00)
Stern (69:31.00)
Ullman (69:33.00)
Weber (68:20.00)

Non-unionized jobs appear to be the hardest hit by new technology because of the lack of adjustment mechanisms, compensation and planning for change in this sector. This has been documented the most in relation to unskilled farm workers but white collar, professional, and technicians jobs are not free from displacement by technological change either. Some non-unionized sectors have been shown to have used advanced planning for change and adjustment quite effectively to reduce the employment impacts of technological change.

Part I of this report attempted to cover the essential, conceptual issues related to worker adjustment and technological change. This began with a rather technical discussion of production function shifts, cost changes and resultant employment effects, in the aggregate and by skill group. Part I concluded with a discussion of adjustment mechanisms viewed through the perspective of formal welfare theory in which various policies issues were outlined.

Part II outlined the current state-of-the-arts concerning the actual impact of technological change on employment and the various mechanisms that have developed, in the public sector and private sector, to aid worker adjustment to change. The literature does point out, in general, the wide spread use of adjustment mechanisms in the private sector and the need for full employment; however, as can be seen by the diverse policy recommendations found in the literature, considerable difference of opinion does exist as to the actual extent of technological displacement and as to the value of various approaches to aiding worker adjustment. These differences can be explained, in part, by the many areas of incomplete knowledge and the inconclusive evidence found to exist in the current state-of-the-arts.

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